The Journal of Occupational Diseases and Traumatic Surgery

Industrial Medicine

for

Physicians and Surgeons in Industry

Volume 9 MARCH, 1940 Number 3

THIS ISSUE

Compressed Air Illness
—With Special Reference to the Middle Ear—

Traumatic Surgery
—Some Principles of Treatment—

Compound Fractures
—Management and Treatment—

Hyperparathyroid Disease
—Manifestations of Interest to Industry—

Tuberculosis Case-Finding
—With Special Reference to Hospital Employees—

The Endocrines in Heart Disease
—Study of the Endocrine Factor—

Central States Society
—Proceedings of Joint Meeting with St. Louis Medical Society, St. Louis, February 9, 1940—

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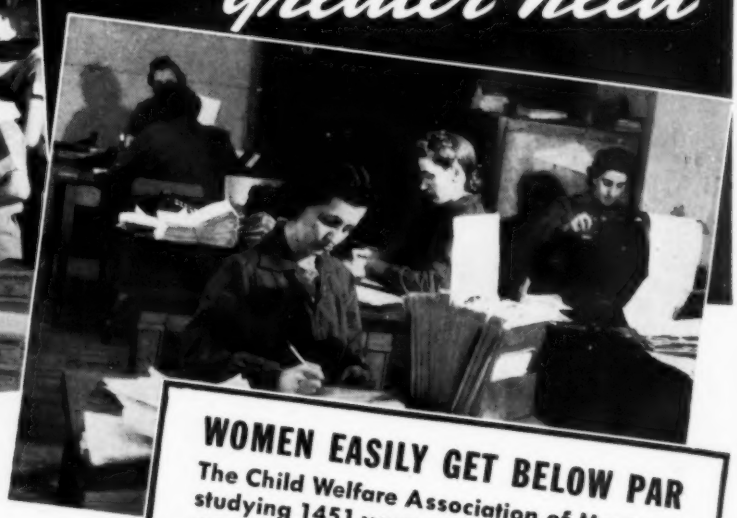

Women Workers Often Subject to NUTRITIONAL ANEMIA

Fatigue, absenteeism and sub-standard performance often are due to low hemoglobin levels.

Women's Iron Requirements High

Up to the menopause, women require *four times as much iron as men.* Blood loss due to menstruation, dietary deficiencies of the low income groups, and the common concern of women to avoid excess weight, lead to a far greater incidence of secondar, anemia among women workers, than among men.

Much Food Iron is Unavailable

Many widely consumed foods are deficient in iron. In others, cereals such as oats and wheat, for instance, only about 50% is available; in parsley and spinach only 20%.

Copper Often Lacking

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WOMEN EASILY GET BELOW PAR

The Child Welfare Association of Montreal studying 1451 women in the lower income groups, found 43.2% exhibiting various degrees of anemia[1]. In another study, out of 603 women, 88% fell below 13.5 gm. Hb per 100 c.c. of blood[2]. Similar studies[3] bear out the same thesis, that women more often than may be suspected, suffer from nutritional, iron-deficiency anemia.

1. "The Incidence of Anemia in Women of the Low Income Class," W. R. Kennedy, B.Sc., M.D. Can. Med. Assn. Jour. 40, 134, Feb., 1939.
2. "Nutritional Iron Deficiency Anemia" Davidson, Campbell & Fullerton study—British Med. Jour. 1935, 2:195. Quoted in Can. Med. Assn. Jour.
3. Heath & Patek—Medicine, 1937, 16:267.
Also see McCollum, E. V., "Recent Advances in Nutritional Research."

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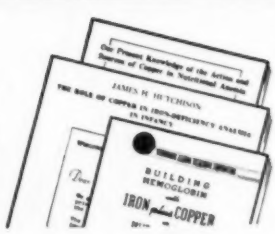

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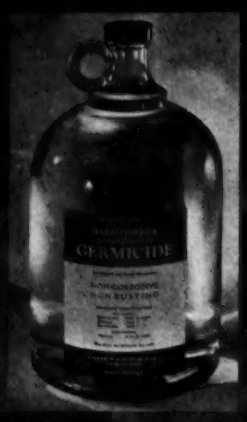

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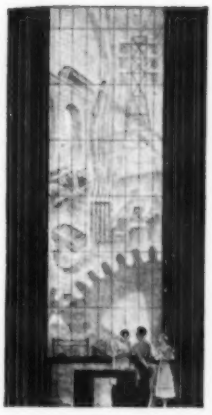

OCCUPATIONAL DISEASES
TRAUMATIC, INDUSTRIAL

INDUSTRIAL MEDICINE
& RAILROAD SURGERY

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BY WAY of good beginning, Drs. Requarth and Benson open this issue with the expressed purpose of summarizing the present medical status of "Compressed Air Illness" and emphasizing the industrial importance of middle ear affections in low pressures. The conclusion that they accomplish their purpose admirably and interestingly must be unanimous on the part of all who read. « » Dr. Sayers' "Health Problems of Workers" (page 121) has an important message on the need and the value of the joint effort of the industrial physician and the industrial hygienist in the control of health hazards in employment. « » Dr. Heller's "Hyperparathyroid Disease" (page 125) was first presented at a meeting of the American Association of Railway Surgeons, and is published here with the subsequent results of some follow up as to one of the cases. And, being so published, it meets the requirement of authenticity that it is now "in the literature." « » Dr. Hutton's "Endocrines in Heart Disease" (page 135) was received with great interest by the New York Central Surgeons who heard it given at their recent meeting. It merits equal interest on the part of the surgeons who will find it here to read. « » The little item on page 138 about the

—Continued on page 5.

INDUSTRIAL MEDICINE, The Journal of Occupational Diseases and Traumatic Surgery, entered as second class mail matter at the Post Office at Beloit, Wisconsin, under the Act of March 2, 1879. Published on the fifth of each month by INDUSTRIAL MEDICINE PUBLISHING COMPANY, Beloit, Wisconsin. R. F. COLLINS, President; A. D. CLOUD, Managing Editor; A. G. PARK, Vice-President; C. F. KARSTAEDT, Secretary-Treasurer. Edited by: S. O. BLACK, M.D., F.A.C.S., Spartanburg, South Carolina; JAMES T. CASE, M.D., F.A.C.S., Chicago; VOLNEY S. CHENEY, M.D., F.A.C.S., Medical Director, Armour & Company, Chicago; BRADLEY L. COLEY, M.D., F.A.C.S., Chief Surgeon, New York Central System New York; HART E. FISHER, M.D., F.A.C.S., Chief Surgeon, Chicago Rapid Transit Company, Chicago; JOHN G. FROST, M.D., F.A.C.S., Chief Surgeon, Chicago & Eastern Illinois Railway Company, Chicago; OTTO P. GEIER, M.D., Director Employee Service, Cincinnati Milling Machine Co., Cincinnati, Ohio; EMERY R. HAYHURST, M.D., Consulting Industrial Hygienist, Columbus, Ohio; WILLIS W. LASHER, M.D., F.A.C.S., Chief Surgeon, Employers Liability Assurance Corporation, New York City; ROBERT T. LEGGE, M.D., Berkeley, California; L. W. LOCKE, M.D., Utica, New York; OSCAR L. LEVIN, M.D., New York City; WM. D. McNALLY, M.D., Chicago; M. N. NEWQUIST, M.D., Assistant Director, American College of Surgeons, Chicago, Medical Director, The Texas Company, New York; FREDERICK W. SLOBE, M.D., F.A.C.S., Medical Director, Sinclair Refining Company, Chi-

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FLORIDA ASSOCIATION OF INDUSTRIAL SURGEONS means that another component society of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS is in being. « » DR. BRAHDY'S "Tuberculosis Case-Finding" (page 139) will be welcomed by those who, with him, are encountering the increasing complexities of the subject. « » DR. MONTGOMERY (page 143) gives a brief review of the "difficult problem of mechanical obstruction of the bowel." « » DR. ANDERSON (page 144) stresses prevention as more than a possibility in "Traumatic Surgery." « » DR. BOYD (page 147) follows with comments on the management and treatment of "Compound Fractures." « » DR. MCNEALY'S "Separation of the Acromio-Clavicular Joint" (page 149) is interestingly and authoritatively presented. « » THEN comes DR. SAPPINGTON'S abstract (page 151) of the Joint Meeting of the CENTRAL STATES SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY and the St. Louis Medical Society at St. Louis last month. And this is followed by something DR. SAPPINGTON wrote in April, 1931 — "A Diagnostic Study of Industrial Medicine" (page 156). This, from the archives, is further proof that the field of industrial medicine, and the problems peculiar to it, were tangible and had form and scope and boundaries long ago, and that the successive Balboas who climb the hill from which they can look out for the first time upon their broad expanse are only confirming over and over again the existence of a Pacific which was already an old story to the captains who, long before, had measured its tides, charted its currents and studied its intimate geography. « » DR. FELDMAN'S "Dark Adaptation" (page 158) brings to definite attention a subject that is certain to be of increasing interest to all medical examiners in lines of work where men handle automotive machinery. His presentation is an important addition to the literature, and the technique of the problem. « » DR. LASHER'S "Initial Treatment of Industrial Accidents" (page 161) possesses, along with the background and experience which make it authoritative, a quality of forthright sincerity that is gripping in inten-

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cago; Consultant, C. O. SAPPINGTON, M.D., DR. P.H., Consulting Industrial Hygienist, Chicago. Official Publication of: American Association of Industrial Physicians and Surgeons; American Association of Railway Surgeons; American Industrial Hygiene Association; Association for Advancement of Industrial Medicine and Surgery; Association of Railway and Industrial Physicians and Surgeons of Kansas City; Association of Surgeons of the New York Central System; Association of Surgeons of the Southern Railway System; Central States Society of Industrial Medicine and Surgery; Chicago Society of Industrial Medicine and Surgery; Georgia Industrial Surgeons' Association; Institute of Traumatic Surgery; Michigan Society of Industrial Physicians and Surgeons; Milwaukee Association of Industrial Physicians and Traumatic Surgeons; New Jersey Association of Industrial Physicians and Surgeons; New York State Society of Industrial Medicine. PUBLICATION AND EXECUTIVE Offices: 413 Pleasant Street, Beloit, Wisconsin; EDITORIAL Office, 540 No. Michigan Ave., Chicago, Illinois. Subscription $5.00 per year in the United States; $5.50 per year in Canada; $6.00 per year in other countries. Single copies 50 cents. Title Registered in U. S. Pat. Off. Copyright, 1940, by Industrial Medicine Publishing Company. Advertising Manager: STEPHEN G. HALOS, 540 N. Michigan Avenue, Chicago. Eastern Representative: HAL D. CHAPMAN, 808-110 E. 42nd St., New York City.

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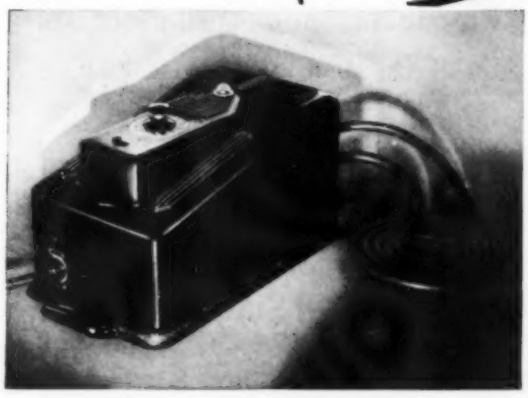

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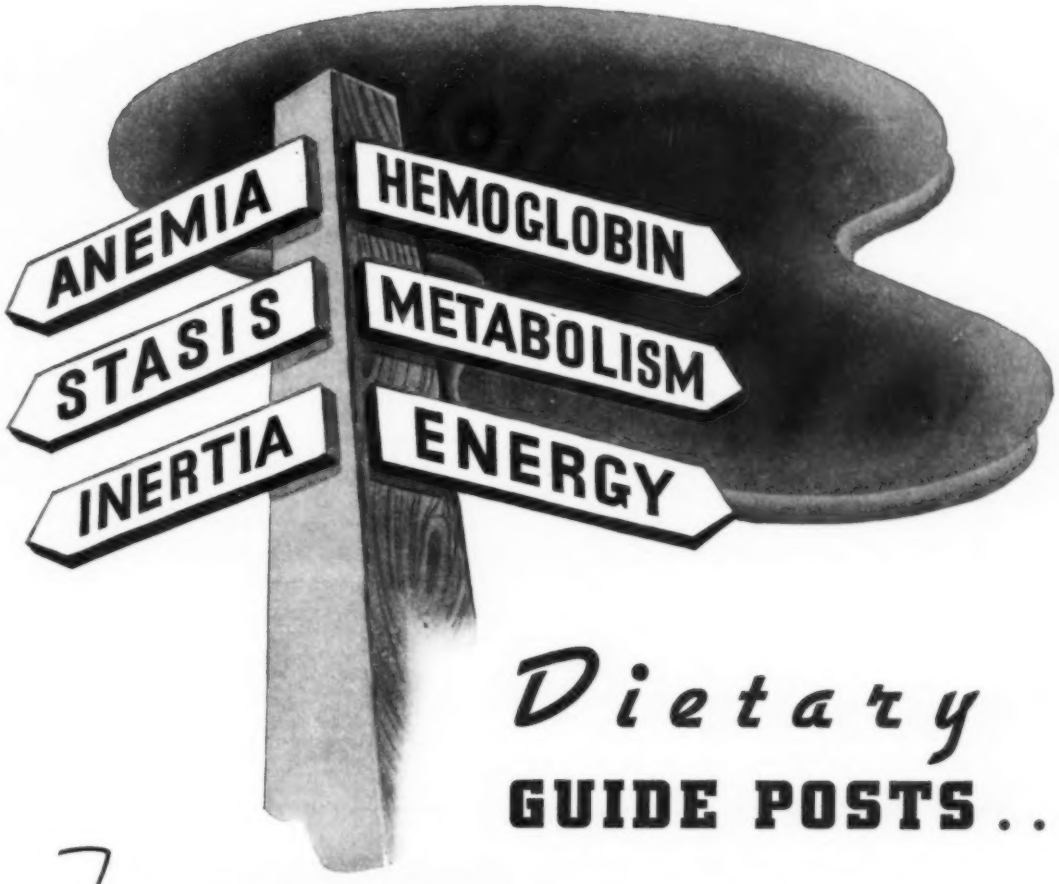

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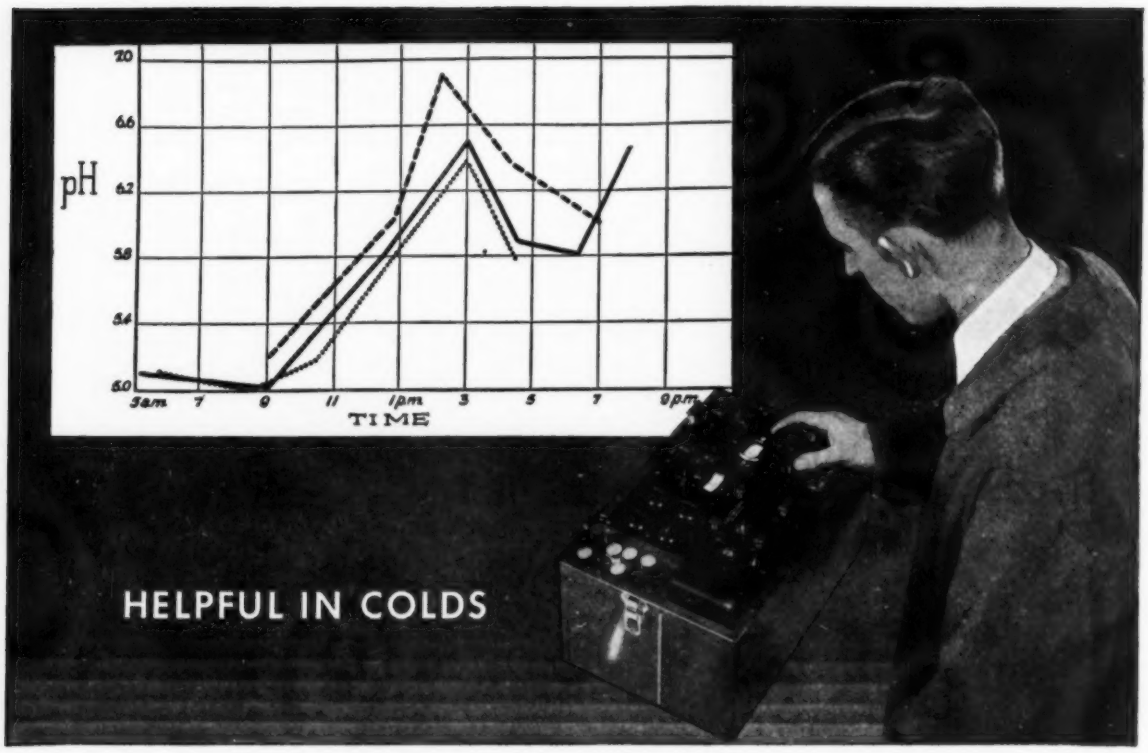

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—*Continued from page 5.*

sity and compelling in interest. This article will be widely, and profitably read. « » FOLLOWS, then, the third instalment of our abstracts of the principal papers and discussions of the Fourth Annual Meeting of AIR HYGIENE FOUNDATION at Pittsburgh, last November. The January issue, on page 35, set forth the Program, and, on pages 36-38, the Symposium on Sick Absenteeism; and in the February issue, on pages 92-94, MR. FLETCHER's talk on "An Employer's Viewpoint on Industrial Health" was summarized. And here, on pages 164-167, will be found the third subject of the second day of the meeting, the abstract of the Forum on the "Impact of Employee Health on Industrial and Public Relations." V. P. AHEARN, Executive Secretary of the National Industrial Sand Association, C. C. CARR, Advertising Manager, Aluminum Company of America, and DR. C. O. SAPPINGTON were the speakers. Then, on pages 167 and 168, is the substance of ROBERT J. WATT's discussion of "Labor's Viewpoint on Occupational Disease Prevention," which was on Tuesday's program. « » "JUNE MEETINGS" (page 169) offers the tentative program for the *Twenty-Fifth* Annual Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, at New York, June 4, 5, 6, and 7, 1940, and forecasts an equally imposing array of subjects and speakers on the part of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION. The first two days, Tuesday and Wednesday, June 4 and 5. will be in charge of the last-named organization. The Program Committee comprises GORDON C. HARROLD, WARREN A. COOK, H. H. SCHRENK, PHILIP DRINKER, and WILLIAM P. YANT. The third and fourth days, Thursday and Friday, June 6 and 7, will be given over to the industrial physicians and surgeons. DRS. L. A. SHOUDY, R. R. SAYERS, and C. H. WATSON are responsible for this part of the program. The complete details of all four days' proceedings will appear in these pages as soon as the Committees have them ready. Meanwhile the indications of page 169 promise a series of sessions worth going a long way to attend. « » THE editorial (page 170) notes some significances of the fact that the forthcoming meeting of the A.A. I.P. & S. marks the end of the first quarter-century of the existence of industrial medicine as *organized*

—*Continued on page 15.*

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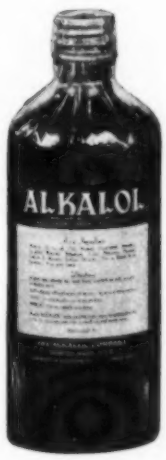

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—Continued from page 13.

medicine. «» FROM DR. D. M. SHAFER, of the N.A.M. Committee on Healthful Working Conditions, comes the pamphlet which is reprinted here (pages 171 and 172), and with it the following letter:

"The problem of industrial health has two sides to it.

"In the large plants employing thousands of men, it is unusual to find anything less than the best of medical and surgical attention under the care of a complete staff of physicians and registered nurses. But in the small plants with less than 500 employees the answer is not so satisfactory.

"And what makes the matter so important is the fact that 62% of all the country's manufacturing employees earn their livelihood in the small sized plants, the very plants that have the greatest need for medical service.

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"The 'why' and 'how' of this method is outlined in the booklet. 'Who's Too Small — for industrial health?' It is offered for use or comment with the thought that through your pages an essential part of industry may have the benefit of the experience of some others who are also striving for the ideal of 'healthy employees working in healthy plants.'"

Silicosis Symposium Transcript

THE official transcript of the Fourth Silicosis Symposium at Saranac Lake, N. Y., last June, is now available. Abstracts of the

—Continued on page 17.

CHRONIC CONSTIPATION

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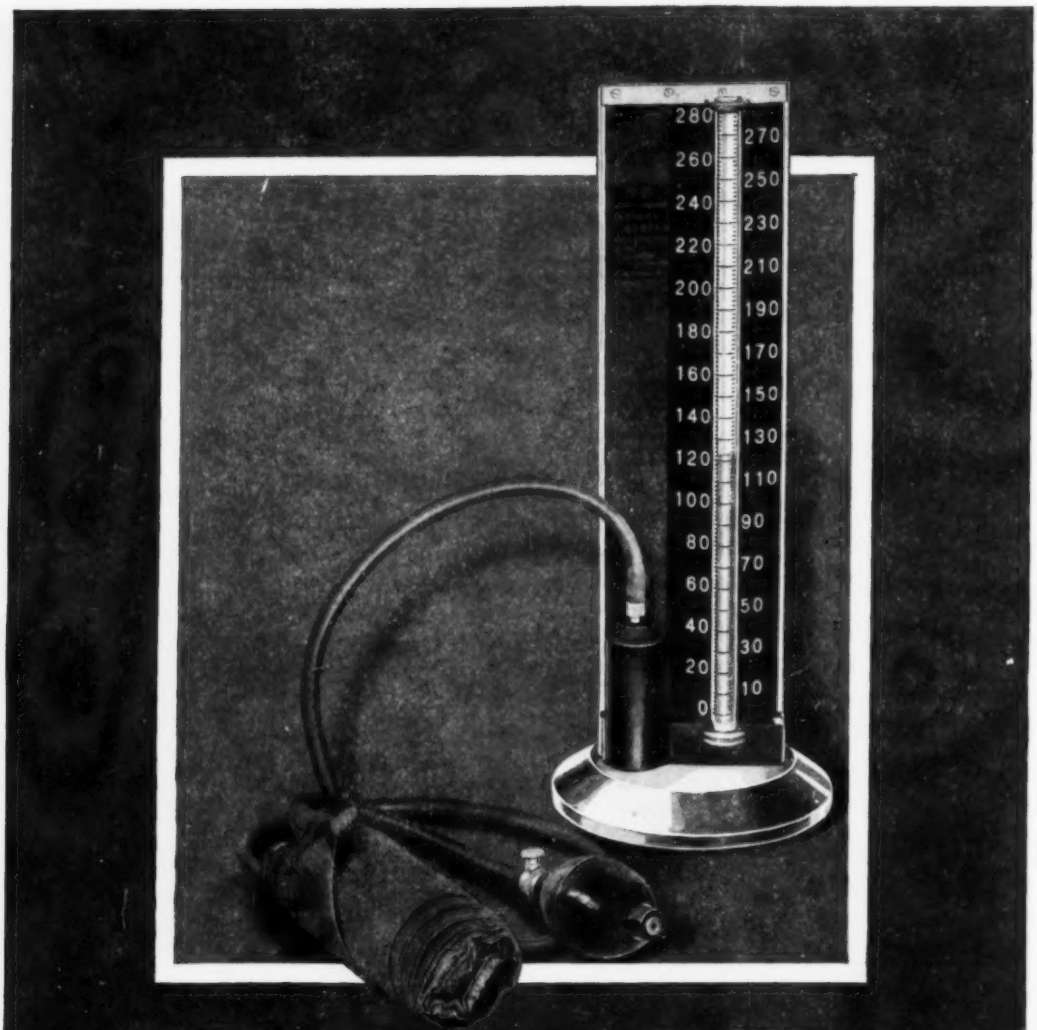

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—Continued from page 15.

proceedings of this symposium were published in INDUSTRIAL MEDICINE for August, 1939, pages 354-361. This edition of the official transcript is edited by B. E. KUECHLE, Vice-President, Employers Mutual Liability Insurance Company, Wausau, Wisconsin, consists of 379 pages with a subject index, and is priced at $3.00.

News

THE ASSOCIATION FOR ADVANCEMENT OF INDUSTRIAL MEDICINE AND SURGERY held a Scientific Meeting on February 28, 1940, at Grand Central Palace, New York City. The subjects were: (1) Can Trauma cause Peptic Ulcers? (2) Can Trauma cause a Peptic Ulcer to Perforate? (3) Can Trauma cause a Peptic Ulcer to Bleed? The discussion was led by DRS. HARRY V. SPAULDING, IRVING GRAY, SAMUEL KALTMAN, and JOSEPH GIFFORD.

THE Fifty-First Annual Meeting of the AMERICAN ASSOCIATION OF RAILWAY SURGEONS will be held at the Palmer House, Chicago, on Monday, Tuesday, and Wednesday, September 16, 17, and 18, 1940.

Prevention of Poisoning

IN connection with the sentence in the editorial (page 170): ". . . . in the most difficult of fields and under the most critical of eyes," the following, from an article on "The Work of the Haskell Laboratory of Industrial Toxicology," by JOHN H. FOULGER, M.D., Ph.D., Director of the Laboratory, in *Delaware State M. J.* for January, is pertinent and interesting: "In the course of events leading up to a traumatic injury, there is no particular point at which a physician can be said to be able to stop the injury. He cannot at any stage say: 'Go no further and no traumatic injury will occur.' In the production of injury due to chemicals, unfortunately, we have no such sudden event, except in the case of overwhelming poisonings. The greatest number of problems in industrial toxicology arise from the long continued exposure to such concentrations of chemicals as might be considered innocuous. The poisoning starts merely as a slight change from the normal, and at every stage, from the first exposure up to the last production of definite poisoning, the industrial physician, given adequate knowledge, can arrest the process by altering the exposure, or by removing and treating the man. In the fu-

—Continued on page 21.

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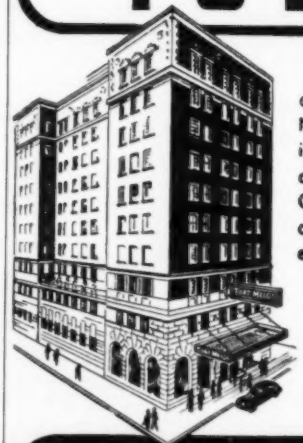

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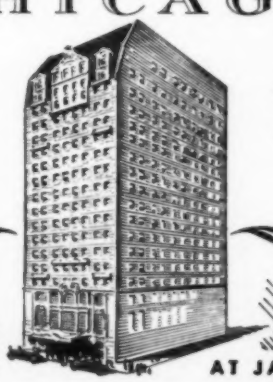

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—*Continued from page 17.*

ture, the occurrence of a definite case of chemical poisoning should be and will be considered as a failure on the part of an industrial physician in a chemical plant to carry out his job. We have then an industrial physician required to show his knowledge before an actual poisoning occurs. It requires much more information to prevent the occurrence of a given event than it does to say that the event has occurred and to try to remedy it. Faced with traumatic injury, the physician has behind him a tremendous amount of information on diagnosis and on treatment, the accumulation of years of experience in surgery and medicine in all fields. Faced with a possible chemical poisoning, the industrial physician has practically no information at hand. With all the literature on toxicology it is our unfortunate experience that comparatively little of it can be applied directly to practical problems in the plant. Toxicology is still suffering from the days in which it was a medical legal study, in which matters of interest were minimum fatal doses, possible cause of death in cases of homicide or suicide. It is not our wish in the chemical industry to have any deaths or to allow any man to be poisoned within reach of death."

Back Numbers

FOR some reason there has been an unusually large demand for copies of INDUSTRIAL MEDICINE for July, 1939, and now our regular supply of extra copies is entirely exhausted. Inquiries, however, do not cease, and so we ask our readers — if there are any who do not make a practice of saving their copies — to help us out. Please send us a postcard if you have a copy of that issue which you would care to dispose of. We will buy a limited number.

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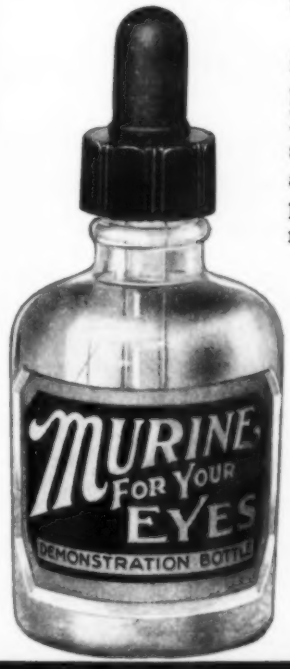

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The Journal of Occupational Diseases and Traumatic Surgery

With which are consolidated "The Industrial Doctor" and "International Journal of Medicine and Surgery."

The Science, the Law and the Economics of Industrial Health

Volume 9 MARCH, 1940 Number 3

Compressed Air Illness

—*With Special Reference to the Middle Ear*—

WILLIAM H. REQUARTH, M.D.,
and
RAYMOND E. BENSON, M.D.,
Chicago

THE use of compressed air in facilitating work in water-bearing strata has become a commonplace in the last decade, having progressed from a make-shift aid to a highly efficient part of underwater construction. Its frequent use in tunnel construction in New York City, Detroit, and more recently in Chicago adds further dangers to an already lengthy list of industry hazards. These hazards were recognized as early as 1850 and many good papers appear in the literature describing methods of prevention and treatment. It is the purpose of this paper to summarize the present medical status of compressed air illness and to emphasize the industrial importance of middle ear affections in low pressures.

In general, all tunnel construction and tunnel operations carried out in compressed air follow a similar pattern. A lock is constructed at a varying distance from the heading. This is composed of two bulkheads several yards apart, depending on the size of the lock, each bulkhead containing an air-tight steel door. These lock doors swing towards the air chamber and close against an insulated frame in such a manner that when the air pressure in the lock is raised to tunnel pressure the outer door is held closed and the inner door can be easily swung open. Men passing from the tunnel to the outside air are kept in these locks and the pressure is reduced at a specified rate. It is the passage from lock to atmospheric pressure that causes compressed air illness, also known as the bends, diver's palsy and caisson disease.

Compressed air illness is a disease caused by the sudden reduction of atmospheric pressure at a ratio which exceeds 2.0 or 2.5 to 1, characterized pathologically by the formation of nitrogen bubbles in the blood and tissues and clinically by severe abdominal pain, pain in muscles and joints and certain neurological signs.

Unlike many diseases the predisposing factors in compressed air illness are of paramount importance. These may best be listed:

1. DEGREE OF PRESSURE. The pressure to which the men are subjected is probably the one most important predisposing factor. In general this varies with the type of work, in tunnels it is as a rule less than 30 pounds, in deep sea diving it may be many times this figure. The pressure is measured in atmospheres, one atmosphere at sea level being equal to 14.7 pounds per square inch, or in metric, 76 cm. of mercury. The pressure is read as the gauge pressure or as the absolute pressure which is merely the gauge pressure plus the pressure of that particular environment. The severity of the diseases varies in direct proportion to the pressure. Haldane[1] has said that there are few illnesses at pressures less than 15 pounds, that symptoms rarely begin until 20 pounds is reached, and are not serious unless the pressure is over 30 pounds. He has not seen a fatal case in pressure below 29 pounds. About 50 pounds is the maximum pressure for working conditions although divers have survived pressures over 10 atmospheres absolute.

2. LENGTH OF EXPOSURE. This is second in importance only to degree of pressure. According to Henry's law, liquids take up in solution a mass of any gas in proportion to its partial pressure. Therefore the blood in the lungs will take up oxygen and nitrogen in proportion to increase in partial pressure. The longer the blood is exposed to this increased pressure, the more gas is taken up until the blood stream and body tissue become saturated. The length of time for saturation varies according to the pressure, but in general it requires four to five hours for the body to become saturated. In order to combat this the working hours have been shortened. Double shifts have

been devised in order that full saturation may not occur. Recently[2] the single working period has been favored instead of the two period schedule previously practiced. It is felt that staying in longer than time necessary for complete saturation is not dangerous with adequate decompression. Rats[3] have been kept for 72 days at a barometric pressure of 3040 mm. of mercury and the only harmful factor in this environment was the increased oxygen tension.

3. Obesity. Obese individuals do not tolerate increased atmospheric pressures and it has been shown[4] that fat increases the susceptibility to death from caisson disease. It absorbs five times the volume of nitrogen as other tissues, is slowly saturated and slowly desaturated thus retarding decompression more than any other tissue.

4. Physical condition. In general, men working under increased atmospheric pressure are subjected to the most strenuous type of physical labor. Consequently, any physical defects accentuate the difficulties of work under these conditions. Important physical factors should be noted according to the periods of pressure to which the man will be subjected. Here, and elsewhere in this paper, we have used 15 pounds as the point of arbitrary division and in doing so we wish to emphasize that below this figure caisson disease never occurs although it may occur in pressures over 15 pounds. In this former group the physician is faced with the problem of eliminating individuals who would be predisposed to Eustachian tube blockage and a subsequent middle ear infection, a condition to be discussed again. Therefore, in examining men for work in pressures of less than 15 pounds, he must search carefully for any inflammatory process in the nasopharynx, such as acute and chronic rhinitis, vasomotor rhinitis, acute pharyngitis, acute and chronic diseases of the paranasal sinuses and middle ear. These last two named are of especial importance. In pressures exceeding this arbitrary division the physician is faced with the added responsibility of eliminating individuals predisposed to compressed air illness. Any individual afflicted with a disease which would inhibit the passage of nitrogen from the tissues to exhaled air, whether this be on a circulatory basis or on the basis of impairment at the respiratory epithelium, might be considered susceptible. Consequently, circulatory deficiencies as cardiac decompensation, advanced arteriosclerosis, thrombo-angiitis obliterans and Raynaud's disease or chest diseases as chronic asthma, bronchiectasis, pulmonary tuberculosis or pneumoconiosis must be eliminated. Other conditions to be avoided are chronic alcoholism, hypertension and gastro-intestinal disorders as peptic ulcer and chronic gastritis.

5. Age. This is variable but minimum age has been set as 17 to 20 and maximum as 30 to 45 depending on the amount of pressure and type of work. It is interesting to note here that in rats[3] subjected to extremely high pressures, the mortality increased directly in proportion to the age.

6. Race. This has no appreciable effect. The American negro probably does not tolerate compressed air as satisfactorily as the other races.

We are indebted to Paul Bert[15] for the first accurate work on the cause of caisson disease. In 1878 he published his classical work "La Pression Barometrique," and showed by animal experimentation that the disease was caused by the liberation of nitrogen bubbles in the blood stream with local or general blockage of the circulation as a result. This is brought about by too rapid decompression. Other investigators have shown this to be true and his conclusions remain valid today.

Pathology

Pathogenesis. Blood reaching the lungs is exposed to a greatly increased partial pressure of nitrogen and oxygen which it takes up in proportion to the increases in pressure. When the blood reaches the tissues these gases are released and the oxygen is quickly absorbed but the nitrogen, being a relatively inert gas, is not absorbed and diffuses out into the tissues. The blood returns for a fresh charge and this is repeated until the tissues are saturated with nitrogen at a partial pressure existing in the air breathed. The amount of nitrogen dissolved varies with degree of pressure, length of exposure and the vascularity and absorptive capacity of the individual tissues.

When the body is saturated with nitrogen the tissues contain 26 times as much nitrogen as the blood alone when saturated. Therefore, in 26 rounds of circulation the body should become saturated. This is not true, however, because vascularity and absorptive capacity of tissues varies. Fat acts as a reservoir for nitrogen, it saturates slowly, will hold five times as much nitrogen as water, and desaturates slowly due to poor blood supply. The white matter of the central nervous system has a high capacity for nitrogen storage due to a high fat content and a poor blood supply which predisposes to slow desaturation. The gray matter has a good blood supply and low capacity for nitrogen. Muscle tissue varies. When the external atmospheric pressure returns to normal, the partial pressure of the nitrogen in the blood and tissues is far above atmospheric pressure and the gas is rapidly released. The tissues become supersaturated with nitrogen and bubbles form. Oxygen bubbles are rapidly fixed by the tissues but the nitrogen bubbles remain in the blood stream until, acting as emboli, they block a blood vessel causing an ischemia in the area supplied by that vessel. If decompression is rapid, bubble formation may be violent enough to rupture blood vessels and thus produce multiple hemorrhages. Symptoms are many and varied according to the location of the emboli. The white matter with its poor blood supply and high fat content is especially vulnerable. The thoracic part of the cord is most often affected.

Pathology. Grossly, the pathology varies according to the part of the body affected. In general there are multiple small hemorrhages and infarcts with subsequent damage to the tissue. Embolic infarctions and hemorrhages in the cord[5] with organization and functional destruction of the segment are followed by ascending and descend-

ing degeneration. Later these areas organize and are replaced with connective tissue. The injuries are miliary in character and thus compatible with life. It is a myelomalacia due to obstruction of the vessels by small emboli and formation of numerous miliary glial scars.

Symptoms

THE onset is sudden, occurring from 15 minutes to 48 hours after exposure. In one half of the cases it occurs within 30 minutes and in 90% within three hours. The symptoms vary according to the location of the emboli.

1. PAIN. This pain is excruciating in nature and is typically located in the abdomen and extremities. It is intense, may be girdling in character and causes the individual to double over. Thus the disease derives its name. Often the pain is located in the joints and muscles.

2. VERTIGO is a common symptom. This may be severe and associated with vomiting and marked nystagmus constituting a Menier's syndrome due to hemorrhage into the labyrinth.

3. CENTRAL NERVOUS SYSTEM LESIONS are often seen in the more severe forms. These are multiple and may be manifested as aphasia, diplopia, retraction of visual fields, transient blindness or mono and paraplegias with urinary incontinence due to cord involvement.

4. DYSPNEA, or the "chokes," is due to pulmonary edema or bulbar lesions.

5. PROSTRATION AND COLLAPSE occur in a small per cent of cases.

The above symptoms constitute the classical picture of the "bends" or compressed air illness encountered only in pressures over 15 pounds. In pressures between three and 15 pounds, workers present complaints chiefly referable to the middle ear which, although relatively minor, assume major proportions from the aspect of industrial compensation insurance.

Involvement of the Eustachian Tube

OF THE minor problems encountered at low pressures, foremost is blockage of the Eustachian tube with attendant inability to equalize the pressure in the middle ear. The pathogenesis of this is simple and familiar to most physicians. There is commonly a predisposing factor present as pharyngitis or sinusitis and as the workman forces air into the Eustachian tube during compression some of the contaminated secretions of the nasopharynx enter the orifice of the tube. There results a catarrhal inflammation of the tube with subsequent obliteration of its lumen. The next time the man enters the lock, the air cannot enter the middle ear, the pressure is not equalized and the resultant deformity of the drum membrane produces pain and a varying degree of tinnitus. It is estimated that about 8% of these cases progress to a true otitis media. This is probably a conservative figure.

We have recorded 70 cases of tubal blockage. In 64, or 91%, there was a definite history or evidence of an upper respiratory infection. In this group of 64, 53 or 83% were afflicted with the common cold; four, or 6%, showed evidence of sinusitis; and seven, or 11% showed evidence of pharyngitis. In this last group, four had subjective symptoms of sore throat and three had no subjective symptoms but there was objective evidence of pharyngeal inflammation. In the remaining six cases we were unable to obtain a history or clinical evidence of any infection. This does not necessarily mean there was none, and in the light of the high percentage which did give this evidence one would conclude that there was probably a subclinical infection existing. None progressed to otitis media and we attribute this to a well regulated prophylactic program. It seems that workmen in compressed air are particularly predisposed to such upper respiratory infections and this can be logically explained. Air under pressure has a higher temperature due directly to the mechanics of compression. Frequently, the collecting chambers on the surface used for storage, are exposed to the sunlight which further raises the temperature. Daily temperatures recorded in this tunnel heading often reached 80° Fahrenheit. As the pressure is released, the air vaporizes and the temperature drops. The workman is suddenly changed from a warm environment to the cold damp conditions of the lock.

Prophylactic Treatment

MEASURES IN PRESSURES UNDER 15 POUNDS: The object here is to select only good physical specimens and to prevent the more serious and costly middle ear infections.

1. General physical examination.

2. Critical examination of the nose and throat for any evidence of pharyngitis, rhinitis, sinusitis, nasal polyposis or extremely carious teeth accompanied by low grade gingivitis. A history of repeated upper respiratory infections, asthma, and other possible predisposing conditions constitutes a basis for rejection.

3. Adequate instruction of the men regarding prevention. This should include a demonstration of the Valsalva inflation of the middle ear. Typewritten copies of instructions are placed in the locker rooms and bottom of the shaft. It must be emphasized that any employee who enters the lock with a head cold without first reporting to the medical officer is subject to dismissal.

MEASURES IN PRESSURES OVER 15 POUNDS:

1. Selection of men by a qualifying physical examination. With the exception of decompression, this is probably the one most important preventive measure. This examination must be careful, unhurried, and performed by a conscientious physician competent to judge the physical disabilities of this class of men. Obviously, it should include a careful evaluation of the conditions outlined in pressures under 15 pounds. In addition, special stress should be laid on other factors.

(a) Past experience. Generally speaking, a man who has tolerated compressed air before can tolerate it again. Inexperienced men may be put in a recompression tank and exposed to the exist-

ing pressure in the tunnel. A few contractors refuse applicants with no experience in compressed air. This is obviously impractical and new men should be given the benefit of the above test before refusal.

(b) Age. As previously stated, the ideal age limits have been set as 17 to 30 years. In the case of skilled workers, the upper limit may be increased to include men of 40 years but it is unsafe to exceed this age. Older men do not tolerate increased atmospheric pressure. There are a number of factors responsible for this, chief of which is impaired circulation due to beginning sclerotic changes in the vascular system.

(c) Obesity and chronic alcoholism are absolute contra-indications.

(d) Circulatory impairment. This includes those vascular disorders already named.

(e) All workers should be re-examined quarterly. A man absent from work over a period of 10 days should be re-examined. Obviously, it will be difficult to strictly adhere to many of the physical criteria and certain exceptions will have to be made from time to time in the case of skilled workmen. The physician must honestly evaluate all factors and be firm in his decisions.

2. Good hygiene. Certain principles of hygienic living are essential:

(a) Avoidance of alcohol.

(b) Regular bowel movements.

(c) A total of eight hours sleep daily.

(d) The diet should be low in fat and the meals moderate in quantity.

(e) The effects of rapid cooling during decompression can be offset by taking additional clothing into the lock.

3. Limitation of hours of labor. This was the earliest preventive measure in compressed air illness. It is still practiced today in conjunction with decompression. Each State sets forth in its labor law the minimum hours of labor per shift and this varies somewhat between the different States. The New York Industrial Code[9] may be taken as a standard. It is the most recently revised, and although not up to the British standards, it is the best practiced in this country.

"Pressure shifts and intervals — the working time in any 24 hours should be divided into two shifts under compressed air with an interval in open air. Persons who have not previously worked in compressed air shall work therein but one shift during the first 24 hours. No person shall be subjected to pressure exceeding 50 pounds except in emergency. The maximum number of hours to each shift and minimum open air interval between the shifts during any 24 hours for any pressure, as given in columns one and two of the following table, (see Table I) shall be set opposite such pressure in columns three, four, five and six."

TABLE I
Hours of Labor

	Gauge Press.	First Shift	Interval	Second Shift
	0–18	4	½	4
Lbs.	18–26	3	1	3
per	26–33	2	2	2
sq.	33–38	1½	3	1½
inch	43–48	¾	5	¾
	48–50	½	6	½

—from New York Industrial Code (9)

Interrupting the hours of work prevents full saturation of the body with nitrogen and thus decreases the hazards on decompression. However, recently a group of British engineers[2] have produced evidence which indicates that the single working period is better than the two period schedule now in use. The time required for saturation of the body is four to five hours. They felt that superseding this time was not dangerous with adequate decompression. Their recommendations regarding the limitation of hours of labor were as follows:

TABLE II
Working time—One Shift

0–25	8 hours including ½ hr. meal time
25–40	6 hours including ½ hr. meal time
40–50	4 hours with meal during decompression

—from Institute of Civil Engineers, London (2)

TABLE III
Working time—Two Shifts

0–25	4 hrs. — ¾ hrs. — 4 hrs.
25–40	3 hrs. — 3 hrs. — 3 hrs.
40–50	2 hrs. — 4 hrs. — 2 hrs.

—from Institute of Civil Engineers, London (2)

The interval between shifts includes decompression time.

4. Decompression. There have been three methods of prevention used in caisson disease namely, limitation of hours of labor, uniform decompression and stage decompression. The first was early used by Triger, the French engineer. Its obvious disadvantages are readily seen. Uniform decompression was devised by Pol and Watelle in 1854 who first recognized the dangers of compressed air and describe the symptoms of caisson disease. In order to be efficient it has to be extremely slow and this increases the exposure to high pressure. Furthermore, it does not make use of the difference in the pressure of the nitrogen in the body and in the air breathed to desaturate the tissues more rapidly. The pressure is released at the rate of 0.1 atmosphere per two minutes and if the total pressure is over three atmospheres the rate is 0.1 atmosphere per two and one half minutes.

In 1907 Haldane published his classical work on stage decompression. His method has halved the time factor in decompression and remains today as the most efficient weapon in prevention of the disease.

Stage Decompression

AS PREVIOUSLY explained, the onset of compressed air illness occurs with the sudden appearance of nitrogen bubbles in the tissues and blood stream. It was observed that when the atmospheric pressure did not exceed 1¼ atmospheres, no symptoms due to bubble formation oc-

curred no matter how long exposure or how rapid decompression. Haldane[7] reasoned that since the volume of nitrogen liberated would be the same when the total pressure was halved whether that pressure be high or low, it would be as safe to decrease the pressure rapidly from four to two or from six to three as they knew it was from two to one. The method was tested at the Lister Institute in London in 1908 on goats and then on men. The ratio was found to be correct.

Haldane expresses his view as follows: "The principle of this method is that the diver or worker in compressed air is brought rapidly to half the absolute pressure (or a little further if his tissues are not saturated), stopped there for a time, then decompressed a little further after sufficient time has elapsed to allow maximum nitrogen pressure in any part of his body to become not more than twice the nitrogen pressure at the lower stage. He is then brought on by further stages on the same principle until he reaches atmospheric pressure."

Stage decompression has become the most efficient single preventive measure in the treatment of caisson disease. It is used by divers in the British Admiralty and the United States Navy in an unmodified form. However, among compressed air workers in other countries and States it is used in a modified form. The New York law[9] may be taken as an example of existing regulations today pertaining to decompression. This State prescribes that "a stage decompression shall be used in which a drop of one half of the maximum gauge pressure shall be at the rate of five pounds per minute. The remaining decompression shall be at a uniform rate and the total time of decompression shall equal the time specified for the original maximum pressure."

(a) 0-15 lbs. per sq. in. (gauge pressure) 3 lbs. per min.

(b) 15-20 lbs. per sq. in. (gauge pressure) 2 lbs. per min.

(c) 20-30 lbs. per sq. in. (gauge pressure) 3 lbs. every 2 min.

(d) 30 lbs. per sq. in. (gauge pressure) 1 lb. per min.

This lowers the pressure from ½ gauge pressure instead of ½ of absolute pressure which would shorten the time of the last stage.

Viz. 50 lbs. pressure (gauge):

50 plus 15 lbs. atmos. pressure equals 65 lbs. absolute pressure.

65/2 is 32½ lbs. or a gauge pressure of 17½ lbs.

A drop of ½ gauge pressure would start the second stage at 25 lbs. instead of 17½ lbs.

Many decompression tables have been devised and the most important assumption in working out these tables is that different parts of the body saturate and desaturate at different rates. Desaturation is not necessarily a reversal of saturation. It requires from a few minutes to several hours for different parts of the body to become saturated with nitrogen, but in man saturation is complete in about five hours. The tissues have been divided up[7] into 5, 10, 20, 40 and 75 minute tissues according to the time required for saturation. In general, the progress of saturation will follow the line of a logarithmic curve assuming that the circulation of blood is constant. The method,[10,11] of calculation for determining the degree of saturation of the theoretical tissues is too involved for discussion here.

The British[2] have the following useful table:

TABLE IV
DECOMPRESSION TIMES FOR VARYING PERIODS OF EXPOSURE IN COMPRESSED AIR

Gage press. lbs. per sq. inch	Red in two min. gage press.	For working periods of: 6 hrs.		4 hrs.		3 hrs.		2 hrs.		1 hr.		½ hr.	
		Time min.	Min. lb.	Time min.	Time lb.	Time min.	Min. lb.	Time min.	Min. lb.	Time min.	Min. lb.	Time min.	Min. lb.
22–24	4	10	2½	8	2	4	1	0	0	0	0	0	0
24–26	5	20	4	15	3	8	1½	5	1	0	0	0	0
26–28	6	33	5½	27	4½	21	3½	12	2	4½	¾	0	0
28–30	7	45	6½	35	5	28	4	21	3	7	1	0	0
30–32	8	52	6½	44	5½	36	4½	28	3½	12	1½	0	0
32–34	9	59	6½	50	5½	45	5	36	4	18	2	4	½
34–36	10	70	7	60	6	55	5½	40	4	20	2	5	½
36–38	11	82	7½	72	6½	66	6	50	4½	27	2½	8	¾
38–40	12	96	8	84	7	78	6½	60	5	30	2½	12	1
40–42	13	104	8	91	7	85	6½	65	5	33	2½	13	1
42–44	14	112	8	105	7½	98	7	77	5½	42	3	14	1
44–46	15	—	—	112	7½	105	7	82	5½	45	3	15	1
46–48	16	—	—	128	8	120	7½	88	5½	48	3	20	1¼
48–50	17	—	—	136	8	127	7½	102	6	59	3½	25	1½

—from Institute of Civil Engineers (2) after Singstad (6)

The times for uniform decompression may be gradually reduced to ⅔ of above figures but the number of recompressions in any one week should not exceed 2% of total decompressions.

The importance of having an accurate recording gauge in the lock is obvious for proper functioning of this method of decompression.

Active Treatment

MEASURES AT LOW PRESSURES. These consist almost entirely in the treatment of tubal blockage, the principal object of which is to equalize the pressure in the middle ear and prevent a major infection of this space. As elsewhere in otology, active treatment of tubal blockage is in the main rather unsatisfactory but certain measures may be employed, chiefly palliative. For equalizing pressure in the middle ear, several

methods are available. The simplest and safest is by the use of a local vasoconstrictor. We employ 2% ephedrin sulfate in normal saline applied either with a nasal spray or dropper bottle. Similar drugs as neosynephrin, benzedrin (racemic benzyl methyl carbamine) and various menthol compounds may be used. Unfortunately this treatment is successful only in early cases. Those which persist after the upper respiratory has subsided may respond to inflation of the tube. The Politzer bag and nose piece is used and if this does not produce results a catheter is passed along the nasal floor to the tubal orifice and the tube is inflated from its pharyngeal ostium.

The type of catarrhal inflammation of the drum membrane associated with tubal blockage responds to 5% phenol in glycerin. We prefer a similar proprietary compound.* Those which progress to suppurative otitis media are relieved by the standard therapy of such ear infections.

2. Measures at High Pressures. This is the active treatment of classical caisson disease or "bends" as it is popularly called.

(a) *Recompression.* Recompression itself remains the most satisfactory therapeutic agent for treatment of caisson disease. The patient is placed in a suitable chamber and then subjected to a pressure which will cause the free nitrogen in the body to go back into solution. When this is accomplished and symptoms are alleviated, the pressure is decreased at a rate which permits the nitrogen to be eliminated as fast as it is released from solution. The United States Navy has developed a standard apparatus consisting of a horizontal chamber of 2-inch steel 14 ft. 7 in. long with an inside diameter of 6 ft. 6½ in. A bulkhead and door divides it into two compartments, the outer 4 ft. 11 in. long and the inner 9 ft. 8 in. in length. This arrangement makes it possible to enter and leave without changing the pressure of the inner compartment. Each compartment is provided with four 3-inch observation ports and there are electric lights, loudspeaker and telephone. The air pressure may be controlled from either the inside or outside.

The amount of pressure and time is gauged by the severity of the symptoms. Ordinarily the pressure is returned to maximum, one half maximum absolute or two thirds maximum guage pressure and kept there for double the decompression time, then slowly released. About 90% get good results the first time but a few have to have multiple recompressions. Light muscular exercise during the recompression stimulates circulation and hastens the release of the nitrogen.

(b) *Use of Oxygen.* Recompression merely reduces the size of the bubble since the volume of the bubble is inversely proportional to the barometric pressure on it. This does little towards removing the bubble and it occurred to Paul Bert as early as 1842 to substitute oxygen for nitrogen in the air breathed to hasten the outward diffusion of this gas.

In recompression, as the barometric pressure increases the size of the bubble decreases until all the nitrogen is in solution. If the pressure is lowered the bubbles reappear and the nitrogen in bubble form is in excess of capacity of blood to dissolve the gas. Nitrogen in the blood stream may be eliminated either by passage into the tissues or through the pulmonary capillaries. The tissues are already saturated so the nitrogen is eliminated through the pulmonary capillaries. Here it encounters a gas, 80% in nitrogen and nitrogen diffusion through the bubble preceeds at a low pressure head. If pure oxygen is breathed and the nitrogen in the blood encounters a gas whose nitrogen tension is zero, the diffusion is much more rapid; in fact it has been estimated[14] that oxygen inhalation accelerates diffusion to a rate exceeding 5.8 times the rate if air were breathed.

When oxygen is used in conjunction with recompression, treatment is advised in two stages.[14]

"I. If patient has serious symptoms (asphyxia, paralysis, loss of consciousness) indicative of extensive bubble formation, reapply pressure to 75 pounds with patient breathing 50% oxygen-nitrogen mixture. This is done for a minimum period of 15 minutes and may extend to two hours if necessary. Symptomatic recovery and absorption of all or nearly all bubbles are objectives in this stage.

"II. Reduce pressure to 30 pounds at rate of one pound per minute. At 30 pounds stop and breathe pure oxygen for one to two hours. This eliminates any residual bubbles following stage I. Now decompress in 30 minutes to atmospheric pressure and this completes the treatment." If symptoms are unrelieved patient may be kept at 30 pounds for some time, breathing air. At the end of 24 hours he may breathe oxygen for two hours. About 90% respond to stage II only.

(c) *Use of Helium.* More recently this gas has come into prominence in the treatment of caisson disease. It is the lightest of all elements with the exception of hydrogen, its molecular weight being only 4. Its rate of diffusion is 2.7 times that of nitrogen and it therefore passes much more rapidly through the respiratory epithelium. The solubility of helium is one half that of nitrogen and consequently it is more easily removed from solution. These properties have made it the subject of extensive experimentation in the prevention of caisson disease. Early results have been very promising although the high cost of the gas is a rather serious obstacle. We are at present using it in tubal blockage with encouraging results.

Summary

THE etiology, pathology, symptoms and treatment of compressed air sickness in pressures over 15 pounds are presented in an orderly fashion.

2. The most efficient treatment is stage decompression. In general, the laws of this country pertaining to work in compressed air recommend a combined stage and uniform decompression which is not equal to the method of stage decompression as practiced in other countries, notably England.

* Auralgan.

3. Workers in increased atmospheric pressures up to 12 pounds present certain symptoms preferable to the middle ear and Eustachian tube. Usually considered minor, these complaints assume major proportions when viewed from the standpoint of workmen's compensation insurance.

4. The only adequate treatment of these middle ear complaints is the prophylactic treatment. This is best carried out by a well planned medical program consisting essentially in careful, intensive education of men in the use of preventive measures and the selection of employees on the basis of critical examination of the respiratory tract.

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Health Problems of Workers

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SOME of the common indices used in evaluating departures from health are: (1) mortality; (2) illnesses causing inability to work as measured by lost time; and (3) minor ailments and impairments not involving lost time but causing discomfort and inefficiency.

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In the present discussion it will be assumed that those not in good health and those having certain physical defects will be given a thorough medical examination and arrangements made for proper treatment of such individuals. As health workers, emphasis is on the preventive phase of this problem. To attack the problem, we first determine the health status of workers today. With this knowledge, it is then possible to plan the necessary corrective measures, to execute them, and to evaluate their effects.

Present Status of Health of Workers

IF WE are to determine when, where, and under what conditions physical and psychical damage is occurring in different employments, we must obtain certain statistics on sickness and death among workers. In other words we should determine the extent of ill health.

KIND OF DATA NEEDED: Some of the information needed to measure the extent of ill health and the effect on health and life of different industrial environments and conditions of work is: Incidence of industrial accidents and occupational diseases; excessive frequency of any other diseases in any occupational group; survey of conditions of the working environment and nature of the work, so that sickness and mortality rates and rates of physical impairment may be computed for persons exposed to given conditions; home environment and social-economic status; physical examination data, especially for groups suspected of being exposed to occupational hazards, and the correlation of physical findings with the nature of the exposure; and laboratory data to supplement some of the information listed above. In addition, mortality data by industry, and preferably by occupation, are also essential for a complete picture of the problem.

ACCIDENT DATA: Although great strides have been made during the past 25 years in the prevention of accidents in industry, this form of injury still constitutes an important problem. According to the last preliminary report of the National Safety Council[1] occupational fatalities fell from 19,000 in 1937 to 17,000 in 1938, or a drop of 11%. In spite of the spectacular achievements which have been made in safety work, special studies still show that we have not reached the irreducible minimum in accident rates. For example, in certain steel companies having good engineering practice, the accident frequency rate for 1932 was 8.1 per million man-hours worked as against 18.1 for the industry as a whole.[2]

OCCUPATIONAL DISEASES: Much has been written concerning the difficulty of obtaining adequate reports of occupational diseases. Today there are 23 States which provide compensation for those disabled from occupational diseases and we are witnessing genuine efforts to obtain more adequate reporting of these diseases. Statistics from various States indicate that the most frequent type of compensable occupational disease is that due to dermatitis, with anywhere from 50 to 70% of the

compensable cases falling into this class. Although more and more information on this subject indicates that occupational diseases account for but a small percentage of the total time lost from all types of disabilities, we, as industrial hygienists, should remember that the control and prevention of occupational disease is our first problem and the study of such diseases enables us to make the necessary contacts for carrying out a general health promotion program.

STUDIES OF HEALTH OF WORKERS: Many studies have been conducted in the last 15 years on the health of workers and the working environment. It is not necessary to discuss in detail the numerous studies of this type which have been made by the U. S. Public Health Service, other Federal agencies, by State industrial hygiene units, universities and industries. For example, our studies of the health of workers in dusty trades have shown the incidence of such diseases as silicosis and asbestosis, and in certain cases it has been possible to determine the approximate amount of incapacitation involved as a result of dust exposure. In our recent anthracosilicosis study[3] it was shown that from 12 to 64% of the hard coal miners exposed to dust showed a decreased working capacity as against only 10% of the coal mine workers of the same age not exposed to dust. In a recent study, Kammer[4] examined 10,000 men in a steel plant, of which 6,100 were old employees and 3,900 were applicants for work. Fifty-nine percent of the old employees had no physical defects of any consequence, while 72% of the applicants were found free from ordinary defects. Thirty-eight percent of the old employees had minor defects as against 27% of the applicants, while 3% of the old employees had major defects as against 1% of the applicants. The most common type of defect among the old employees was dental impairment (42%) as against 14% for new employees. Visual defects ranked second, with 25% for old employees and 14% for new, while hypertension came third with 12% for old workers and 8% for applicants.

Mishler,[5] in discussing the effect of the annual physical examination in raising standards of employee health and efficiency, found in 1935 among 3,072 men examined that 1,864 had no physical defects and 1,208, or 39%, were with physical defects. Of this number 436, or 36%, had these defects corrected by their family physician. In 1938, 508 of these men were re-examined and of this number only 52, or 10% were found to have any defects whatever and 65% of these defects were carious teeth. Only three men of the group had to be removed for serious cause. Only a little over one-half of one percent of all the regular employees in the group, when re-examined, were found to be unfit for their type of employment.

Sydenstricker and Britten,[6] in the analysis of data on 100,000 persons examined for the Life Extension Institute by its 9,000 physician examiners throughout the country, were able to present physical findings on four broad occupational groups. While the differences among the rates for the occupational groups were not large, it was found that for the majority of impairments the labor group was slightly above the professional and business groups. The most notable exceptions were defective vision and nervousness. The agricultural workers, the fourth occupational group in this comparison, compared favorably with respect to most of the defects with the exception of impaired teeth.

These various studies have brought forth definite evidence that some working conditions have a direct bearing on the health of workers. Furthermore, it has been possible to determine the threshold dosage of many air-borne toxic materials and to devise medical and engineering control measures for the prevention of certain diseases in industry.

INDUSTRIAL MORTALITY:

While insufficient data have thus far limited our recognition of health problems in non-industrial pursuits, we have ample evidence to indicate that there exists a greater mortality rate in the industrial population than in the whole group of gainfully employed persons. Excess mortality is especially notable in unskilled workers among whom the death rate from all causes in certain States[7] was found to be 100% in excess of the death rate among agricultural workers.

Although mortality statistics by occupation are useful and important, it is well known that they have definite limitations. For example, they do not afford information concerning sickness that does not terminate fatally. It has been shown by Sydenstricker[8] that a striking contrast exists between sickness and death records. The ratio of respiratory illnesses to deaths from respiratory causes was more than 300 to 1, and the ratio of diseases and disorders of the digestive system showed a ratio of about 200 cases to one death. On the other hand, the ratio of illnesses from certain degenerative diseases was only about 10 cases to one death.

Mortality records quite often do not have the correct occupational designation. For more adequate knowledge of the health studies of industrial workers in general, and of persons in certain specific occupations, mortality data should be supplemented by records of sickness.

INDUSTRIAL MORBIDITY:

While accidents, occupational diseases, and high occupational death rates appear to be impressive, there is no doubt that the least dramatic side is probably by far the most important—namely, the lost time and incapacity due to illness. A vast amount of wasted energy and life due chiefly to preventable illnesses, some of which may be contributed by the working environment, presents a problem in need of our serious attention.

The U. S. Public Health Service has been collecting information for some time on the frequency of sickness causing disability among approximately 200,000 male industrial workers. These statistics show that sickness from respiratory disease constitute 42% of the total illness, while digestive diseases account for 13.5%, and external causes (non-industrial accidents) 9.8%. It

is evident that these three groups alone account for nearly two-thirds of the cases.

Although we have made significant progress in the control of certain preventable diseases, as is evidenced by the declining trend of our death rate in the last 40 years, it is a fact that this saving of life has taken place chiefly in childhood and in early adult life. No significant increase appeared to occur during this period in the average years of life remaining to persons of middle and advanced age. The death rates from some important diseases of adult life have been increasing a phenomenon understandable in the light of the fact that the principal causes of death operating in the advanced years are primarily chronic. Preliminary data from the National Health Survey[9] based on surveyed persons of all ages, show that chronic diseases, including permanent impairments, alone account for six of the 10 days of incapacity due to illness and accidents experienced by the average person per year; and with respect to sickness and accidents, data recently published by the U. S. Public Health Service show in the instance of a public utility that on the average 7.5 days were lost annually by males and 10.9 by females.[10]

These studies further show that approximately half of the deaths from chronic diseases occur in the working ages (15-64), and that about 87% of the persons in this age group are reported to have such ailments. Furthermore, about 50% of those reported with chronic disease fall into the groups under 45 years of age. All of these facts should focus our attention on the problem of chronic disease among younger workers, and it would seem that if an attempt were made to discover these diseases in their earlier stages, a great saving in life and health would be accomplished. In other words, the greatest opportunity today for a substantial prolonging of healthy life appears to be in the field of chronic diseases and the class offering this opportunity is the industrial population.

At the present time the Public Health Service is attempting to stimulate recording of all absences among workers and has developed a simple recording form and a manual of instructions in the use of this form. With a knowledge of absenteeism with respect to frequency, duration, and cause in each numerically important occupational group in a working establishment, we will have the necessary data to aid the management and the public health worker to determine the type of action which should be taken to obtain the maximum reduction in the amount of time lost from work on account of disability.

With reference to the relative importance of accidents, occupational diseases, and illness, limited studies, such as those made by the American College of Surgeons,[11] show that approximately 15 times as much time is lost by a worker annually from general illnesses as from industrial injuries and occupational diseases. Additional evidence on this subject has also been reported by public health workers in Great Britain,[12] where among more than five million persons employed in factories in 1935, there were only 428 cases of occupational disease.

From the above brief discussion, it is evident that we still have an excessively high mortality in certain occupational groups, an excessively high morbidity especially for certain respiratory diseases, and some types of degenerative conditions. It has also been established that some types of physical impairments are found to be more prevalent in certain occupations, especially those involving heavy manual labor.

All of this leads one to conclude that more data are needed, and that much still remains to be done, not only in the control of specific occupational diseases but also in general health promotion among workers.

Methods for Solving Health Problems

INDUSTRIAL hygiene practice involves essentially a program of research, application of research and educational activities. Industrial establishments will carry on a certain amount of research work, especially when it relates to the use of new materials and processes. The present trend in this connection is to study these new materials or processes on a pilot scale prior to their widespread employment in industry. This practice calls for a close collaboration between the production and development departments and the industrial hygiene or health department. So far as the State industrial hygiene divisions are concerned, they, by the very nature of their organization and their responsibility, are most fitted to carry out the application and education phases of the program, leaving the major research phases to Federal, university and other similar agencies.

During the past several years, industrial hygiene practice has grown rapidly so that today there are thirty States and three city health departments actively engaged in this activity; while the number of industrial concerns with industrial hygiene departments has also increased to considerable proportions. In addition, we have had an increase in interest and activity in industrial hygiene on the part of non-official agencies.

In the preceding portion of this discussion it has been shown that industrial hygiene primarily involves a program of health conservation and accident and occupational disease prevention. From this consideration it is obvious that in the practice of industrial hygiene two main types of service are needed. These services are medical and engineering. Under medical services would come the allied professions, such as nursing, the various medical specialties, such as pathology, traumatic surgery, etc. The term "engineering" as used in this discussion includes the broad group of non-medical personnel engaged in public health work, such as chemists, engineers, bacteriologists and biometricians. In other words, the functions coming within the province of the medical department are concerned with the person, that is, his hygiene; while the functions coming within the province of the engineer deal with the environment, the work of all being correlated continuously so as to

attain the improvement in workers' health most efficiently.

It is within the province of the medical department to diagnose diseases and primarily to recognize the existence of such diseases as may be due to the factory environment. The engineer, armed with the findings of the physician, is in a position to learn where control measures are to be initiated. The engineer must study local plant conditions which may be detrimental to health and by precise measurements determine the extent of the hazardous exposure and then devise methods for controlling or minimizing the hazardous conditions and study the effectiveness of these measures.

The basic objectives of a medical control program, insofar as they pertain to industrial establishments, are: (1) to estimate by examination the physical and mental fitness of an employee for work: (2) to maintain and improve the health and efficiency of those already employed; (3) to educate the worker in accident prevention and personal hygiene; and (4) to reduce absenteeism from illness or injury.

It is obvious that these objectives will involve a wide variety of activities and may be best worked out for each individual plant, depending upon local conditions.

The medical phases of an industrial hygiene program in a State agency will include a variety of functions, chief among which are the appraisal of the health of workers in industry, the interpretation of the interrelation between industrial and non-industrial environments upon the health of workers, the guidance of the establishment of adequate medical services in industrial concerns, the study of the interrelations between pre-existing disease and subsequent accidents, or occupational diseases, and the conduct of a general educational and service program.

Although the various methods now at the disposal of the engineer for the control of health hazards will not be discussed at this time, it is our desire to call attention to the close relationship which necessarily exists between the medical and engineering professions, be they in a plant or in an official agency, such as a health department. There has been a tendency on the part of certain individuals and professional groups, to limit the scope of their work. For example, in the past the industrial physician has been prone to confine his work to the medical phases of the program and take no interest in the environmental side of the problem. As a result, the opportunity to conduct effective work has often been missed by the physician. Furthermore, many medical departments in the past have limited their work to the care of accidents and occupational diseases and have overlooked general health promotion among workers entrusted to their care. In a like manner the engineer, too, has confined his work to the control of accidents and occupational diseases. An industrial hygiene engineer—and again the term is used in its broad sense—is primarily a public health engineer. In addition to evaluating the various occupational disease hazards which may come to his attention the engineer, in surveying a plant, should take into consideration such important factors as water supply, possible existence of cross connections, industrial waste disposal, general sanitation, and other environmental factors which have a bearing on health. It should be obvious that since the person cannot be divorced from his environment, that likewise a sharp line cannot be drawn between the professions which practice personal and environmental hygiene. In other words, an environmental hygiene program by itself is no more effective than a personal hygiene program by itself, and to do a complete and effective job of preserving the health of our workers, both activities are essential.

Once the problem in industry has been evaluated by medical and engineering means and everything possible has been done to control the health hazards revealed by such studies, it will still be essential for the medical and engineering personnel to maintain constant vigilance, in order that conditions may be kept safe and improved upon. Constant study of all the environmental factors involved is essential to ascertain whether certain measures are effective. Such practice on the part of the industrial hygienist and the industrial physician appears at this time to afford the best means of controlling industrial health hazards.

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Hyperparathyroid Disease

—*and Manifestations of Interest to Industry*—

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THE occasional reporting of a rare disease serves to bring to light similar cases, or, if this fails, the disease in question is at least defined in relation with other somewhat similar disease conditions. At the outset, therefore, I wish to state that the following case reports are but an incident in the consideration of a group of patients met with in industry, which baffle the clinician and the pathologist alike. Careful search has failed to reveal more than two authentic cases in the Greater Kansas City area, and the author is quite in agreement with Wilder and Howell of the Mayo Clinic in the belief that very few true cases of parathyroid hyperplasia are to be expected in the Mississippi Valley. David Barr, of St. Louis, who reported the first authentic case in the United States in 1929, has been unable to locate only three others in his community, and it might be added that Boyd, of Iowa City, and Compere, of Chicago, have been unable to report finding more than their original respective single cases. With the five "proved" cases from the Mayo Clinic, the four in St. Louis, the two in Greater Kansas City, the case in Chicago and the one in Iowa City, it may be said that there have been only 13 proved cases reported for the North Central States area to date.

Chronology

THE chronology of the disease is interesting and will be briefly outlined:

1877: Ivar Sandstrom, while still a medical student, first discovered the parathyroid glands in a dog and named them from their position as related to the thyroid gland.

1891: Von Recklinghausen described the bone changes, now known to be due to hyperparathyroidism.

1904: Askanazy suspected the relationship between parathyroid glands and decalcification of bone in a case of osteitis fibrosa cystica.

1905: W. G. McCallum, of Baltimore, first recorded the co-existence of a parathyroid tumor and renal lithiasis.

1907: Erdheim noticed the occurrence of parathyroid enlargement in osteomalacia and considered the mechanism as compensatory.

1922: Will first used x-ray therapy applied to the neck and got marked benefit in a case of generalized osteitis.

1925: Mandl first removed a parathyroid adenoma and showed the relationship of the tumor to generalized osteitis fibrosa and alleviated the metabolic abnormalities.

1935: Castleman and Mallory listed 105 cases of the disease since 1925 and added 25 from the literature which they felt to be authentic. (The total to date is probably in the neighborhood of 140 authentic cases.)

1936: Herrman, of Philadelphia, first described the parathyroid nerves and gave anatomical criteria of variations from normal location of the parathyroid glands.

1936: Wilder and Howell[1] outlined the minimal criteria for diagnosis of hyperparathyroidism as follows:

"1. That the report of the case has appeared in the literature.

"2. That the description of the skeletal abnormality present be consistent with that of generalized osteitis fibrosa, or, in the absence of skeletal abnormality, that indisputable abnormality of calcium metabolism characteristic of hyperparathyroidism has been demonstrated by the study of the blood or urine.

"3. That a tumorous enlargement, either adenoma of one or more parathyroid glands, or diffuse hypertrophy and hyperplasia of the entire parathyroid apparatus has been found, either by operation or by autopsy."

Theories and Experimental Data

ONLY a few significant findings based upon experiment will be mentioned in passing. Nonidez and Goodale (1927) and Higgins and Sheard (1928) showed that if chicks were deprived of ultra-violet rays and other sources of vitamin D, a hypertrophy and hyperplasia of the parathyroid glands will follow. Later (1934) Wilder, Higgins and Sheard showed that this hyperplasia could be prevented to some extent in birds deprived of sunlight and vitamin D by the injection of parathyroid extract. They concluded that the ability of the parathyroids to increase the supply of their secretions is a compensatory mechanism to protect the organism against relative degrees of vitamin D deficiency.

Elsom, Wood and Ravdin[2] call attention to the fact that if an excessive amount of parathyroid hormone is administered to dogs, there is a deposit of calcium in the kidneys and the development of a renal insufficiency. They assume the same thing occurs in the human subject and that the sequence of events is as follows: Parathyroid tumor, hyperparathyroidism, disturbed mineral metabolism, deposit of calcium in the kidney parenchyma, excretion of abnormal amounts of calcium and phosphorus in the urine.

Wilder and Howell and others believe that the parathyroid adenoma develops from nests of embryonal cells, which are induced to grow by reason of a deprivation of vitamin D from the economy.

Albright and Ellsworth believe the primary effect of parathyroid hormone is to increase the excretion of phosphorus by the kidneys, thus reducing the serum phosphorus and resulting in a reciprocal rise in serum calcium. Barr expresses his ideas somewhat differently in that he feels that excess of parathormone primarily causes a hyperphosphatemia, which then requires the neutralizing effect of a hypercalcemia.

Since the parathyroid parenchyma is made up of two kinds of cells, e.g. the chief cells and the oxyphile or eosinophile cells, Hanson[3] feels that

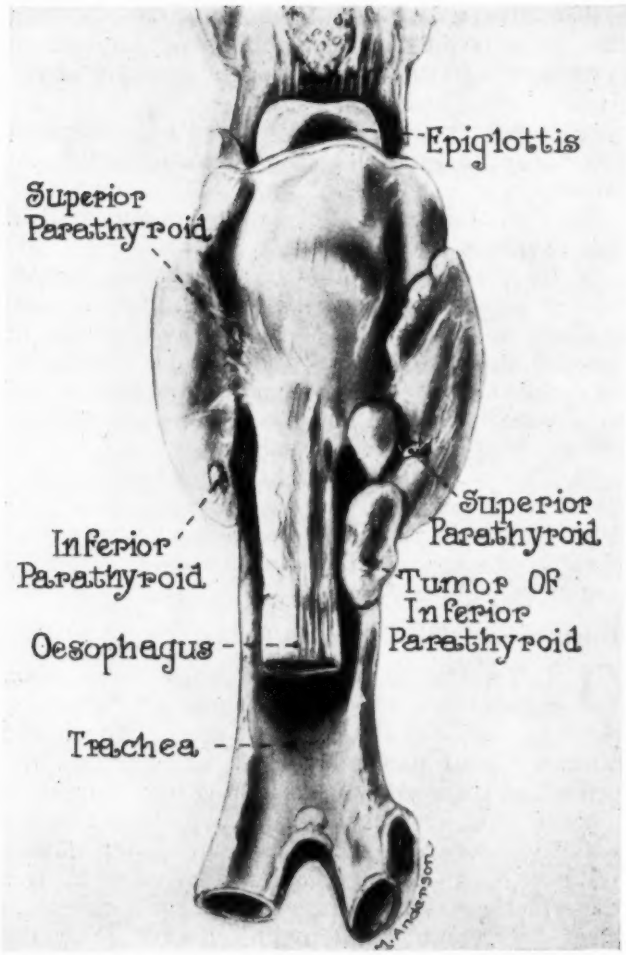

Fig. I. Showing the anatomical relationships of the parathyroid glands with the thyroid gland and other structures in the neck (Case of Drs. Gray, Krall and Allen; Case 1 in the text)

the glands have "at least two functions, namely, control of calcium-phosphorus metabolism, and another yet unknown."

While the physiochemists debate the matter of whether vitamin D stimulates the parathyroids or is merely of secondary importance to the activity of the glands, it is pertinent to quote an ingenious description of the role of the parathyroids by W. T. Wootton[4] as follows: "the glandular influence (is) that of the drayage contractor who procures and hauls truck loads of lime to the building site and dumps it. The masons are represented by the osteoblasts . . . (which) go through life carefully laying the building materials furnished by the parathyroid contractor, probably under the architectural supervision of vitamin D."

Case Reports

WHILE one of our cases has been published[5] and otherwise fulfills the requirements of authenticity laid down by Wilder and Howell, the other case complies with requirements Nos. 2 and 3 and we hope shortly, will qualify for No. 1 through publication "in the literature."

CASE 1:* Father L. M., priest, aged 55 years, born in Germany, Southern part. Had lived most of his life in this country. Mother an invalid 27 years because of bone disease, during which time she suffered many fractures. Patient was exceptionally weak as a child, unable to play as a normal child. Complained of extreme weakness and pain in his legs. In 1924, complained of pain on motion of the right knee and pain in the right leg. X-ray was negative. No diagnosis made.

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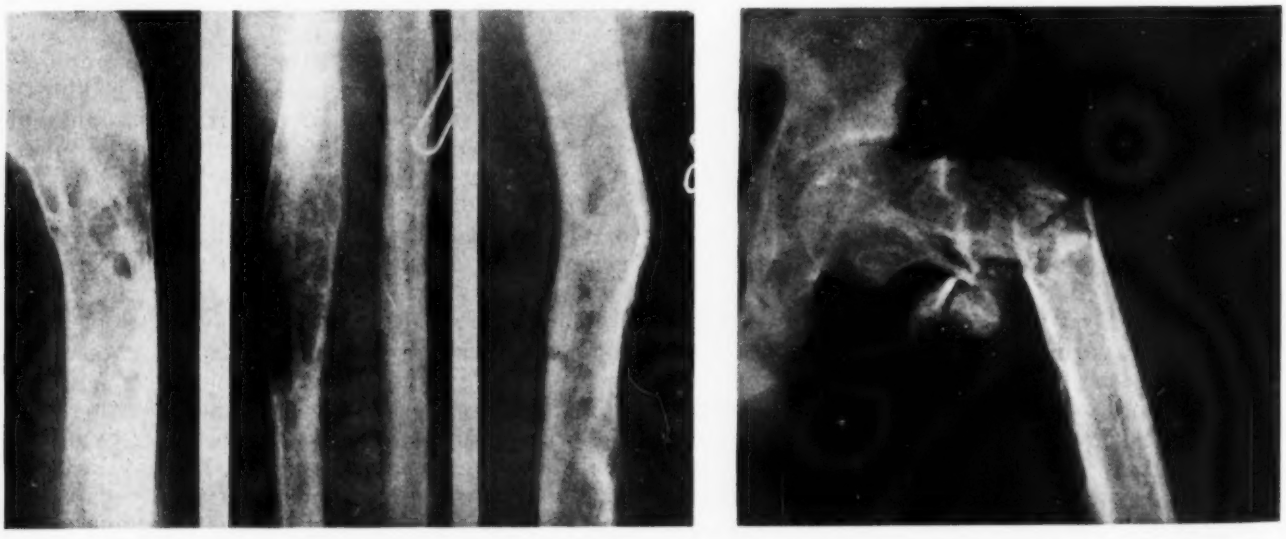
* (This case was under the care of Drs. George M. Gray and P. M. Krall, of Kansas City, Kansas, at St. Margaret's Hospital. The pathological data were accumulated and verified by Drs. H. R. Wahl and R. Kerr, of the University of Kansas Hospital. The x-ray findings were those of Dr. Lewis Allen. The case was reported before the Southwestern Branch of the American Urological Association, at Little Rock, Arkansas, November 14 to 16, 1935, by Dr. O. W. Davidson, of Kansas City, and before the Jackson County Medical Society in the Fall of 1936, at which time the author's own case was reported. The author wishes to express his thanks to each of these gentlemen for their help in obtaining data here presented in summary.)



Figs. II and III. Fig. II is a reproduction of the roentgen findings in Case I. The cystic changes in the bones are well shown and are quite characteristic of the generalized well advanced type of osteitis fibrosa cystica.—Fig. III shows the fracture of the left thigh (Case 2) at the time of admission, and also the osteitis. The areas of calcium absorption are well shown, even in the reduction. Microscopic studies of the involved bone would show replacement of these areas deprived of lime salts by granulation tissue

In 1926, he noted extreme weakness on arising from kneeling. In 1928, he was studied at the Mayo Clinic because of sour stomach and extreme weakness. No diagnosis made or specific treatment prescribed. Following this it was learned from his history that he had always had an abhorrence of salty food and complained of a salty taste in his mouth at all times. He was placed on treatment by Dr. Krall with some improvement. In 1930 he entered hospital because of pain in the right shoulder and knee; also severe pain in his legs. Shortly after admission when placing his arm around the neck of an assistant to raise himself into a chair the weight caused a subcapsular fracture of the humerus. Following this x-rays revealed extensive cystic changes in

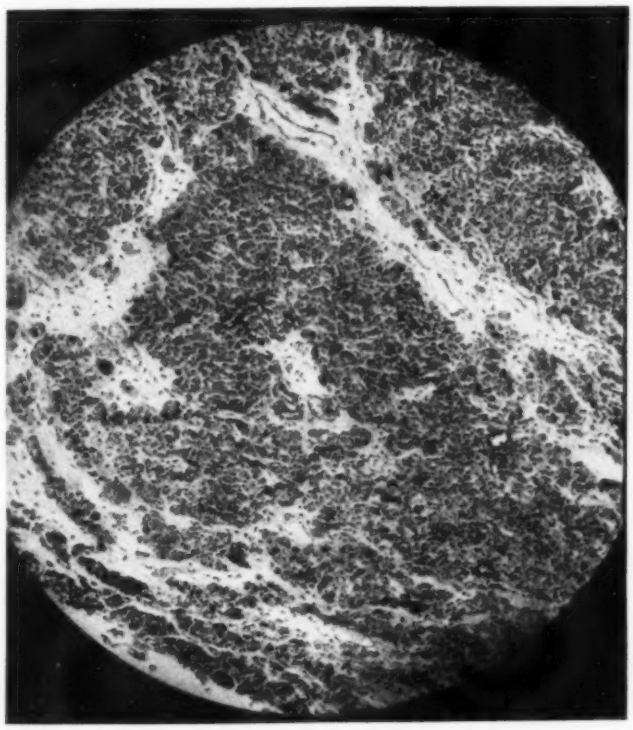


Fig. IV. The photomicrographic picture as presented in the adenoma, Case 1, Fig. I

the bone and he had repeated fractures from any slight stress, even from turning in bed. He remained in the hospital from this time until his death. The diagnosis of possible parathyroid tumor was made by Dr. Krall, but surgical exploration was not attempted. His general examination showed considerable distortion of the bones of the ribs, arms and legs. An x-ray revealed extensive callus formation but no good firm union. Blood count showed a mild secondary anemia. Blood chemistries essentially negative except calcium which showed the following: In December, 1931, calcium 18; phosphorus 2.3. In January, 1932, calcium 15.5; phosphorus 3.3. In February, 1932, calcium was checked at 14.5 and 15 with a phosphorus of 6. In May, 1932, blood calcium was 13.

At postmortem, done October 12, 1932, there was found an adenoma of one of the parathyroids, extreme emaciation, marked metastatic calcification in pancreas, kidneys, and prostate, and the bones of the fingers and arms could be fractured between two fingers with slight pressure.

The accompanying illustrations reveal (1) the anatomical location of the parathyroid glands and of the parathyroid adenoma as viewed from the dorsal aspect; (2) the typical osteitis fibrosa as represented by roentgenograms made of bones of the extremities, and (3) by microphotographic reproduction, the appearance of the parathyroid tumor.

Case 2: J. G., male, age 39, married, presented himself at office December 19, 1935. Occupation, want-ad collector for local newspaper.

Chief complaint was that he was "worn out."

Present illness began about eight years ago when he states that he had begun to feel poorly. Said he regarded it as a "decline" probably due to constipation. Had had no acute infection to usher in his trouble. About time of onset of symptoms began to void urine at night. Voids every two hours day and night and in the aggregate had collected a gallon and a half of urine in a single 24-hour period. No burning or dysuria, or other urinary symptoms.

Gastro-intestinal symptoms are over-shadowed by an intense thirst and obstinate constipation. He described his appetite as "too good." He has suffered with distention, and some sour eructations and occasional heart burn, but has had no actual pain. Has taken all sorts of laxatives and habitually takes enemas. Because of the chain of symptoms described had appendix removed at a hospital in a nearby town two and a half years ago.

On recuperating from the operation he found his ankles so sore he could hardly walk. Later calves hurt and later still his heels and thighs. Has had to use a cane on many occasions to get about. Had often been too weak to work. Has seen a number of chiropractors and medical men and has been told he had flat feet, diabetes incipidis and many other afflictions.

No respiratory or circulatory or genital symptoms except those due to lack of energy.

Weight has been 154 when he was in good health, but has dropped to 140 in past few years.

Previous history: Has usual diseases of childhood. (Had mumps in 1934.) Had sub-acromial bursitis at age 18. Had "lots of boils" as a young man (18 to 23). Says he was a hardy boy who worked at heavy duty on his father's farm. At 21 his father died and he worked harder still — became discouraged and finally went into Iowa to school. Got to feeling fine again. Then got married — has been married 10 years. No children have come of the union, but they have adopted several. After marriage and before onset of present trouble, took clerical job but was dismissed after about two years. Then took a railroad job that was very hard. In the course of time has had an occasional pile and once was told he had some nasal polyps. Fell down a stairway a distance of about 15 feet in 1935. Otherwise no serious injuries.

Family history is not significant except that his father is supposed to have had pernicious anemia.

Fig. V. A—Left—Right femur taken with portable apparatus, but showing, even in the reduction, the osteitis which is so well shown in Fig. I. This is definitely a case of the generalized type of the disease. B—Center—Further evidence of the general character of the disease. Lateral roentgenograms of the skull taken a few days after admission to the hospital to demonstrate the mottled texture of the bone, with what appears to be a large area of absorpion with cyst formation in the temporal bone near the orbit. Note that there is no thinning of the calvarium, but simply generalized absorption of lime salts. C—Right—Lateral roentgenogram of the same skull taken nine months later showing the marked improvement. The bone texture is, to all appearances, normal.

His wife has never had any pregnancies, and has had her menopause within recent years.

Social history: Always has been very abstemious of nicotine and alcoholics. Never worked in hazardous industrial employment.

Physically, patient was found to be a pale-complexioned, middle-aged man who quite evidently was in some distress. He arose slowly from the chair and walked into the office as though his feet or legs hurt him. He had a lanquid, pained facies, and a rather plaintive voice. His weight was 140 pounds, and his height was 5 ft. 9 in.

Head was negative. Teeth were rather too white and chalky, but were well kept. Throat seemed to be normal except for some mild chronic catarrh.

Neck examination revealed a very small enlargement of the right thyroid lobe, but no palpable cervical glands or other abnormalities.

Heart was normal to routine tests; pulse was 70; blood pressure was 142/88.

Lung sounds were normal.

Abdomen was flat and no enlarged organs, masses or hernias were found. Scar of appendix operation was present in the right lower quadrant. There were no tender areas. The musculature was more or less flaccid and one could note some visceral ptosis.

Examination of the upper extremities revealed only a poor development. The thighs were symmetrical and both were tender to deep palpation — especially the right. Calves of legs were likewise tender and painful and were only fairly well muscled. Reflexes were normal. Moderate bilateral pes planus was found to exist.

Back examination was negative except for postural stoop.

Prostatic examination revealed a slightly enlarged organ with some congestion but no pus found on massage.

There were a few hemorrhoidal tabs.

Urinalysis showed a clear, amber fluid, acid, 1024 specific gravity, no sugar and a trace of albumin.

He had a hemoglobin of 80% (Dare).

Impression gained from the history and examination was that we were probably dealing with a case of asthenia from an undetermined source, with slight anemia, flat feet, ptosis, and perhaps a thyroid dyscrasia in addition. Diabetes insipidus and a pituitary factor were also considered on the basis of previous medical diagnosis elsewhere.

Because of the man's financial status, he was fitted with a pair of sponge rubber arch supports and was instructed in home methods to massage and bring up the tone of his muscles. He was given a prescription for some capsules containing an iron tonic. He was also given a jar of a laxative mixture which had been detailed by an ethical drug house containing brewer's yeast and agar and cascara in mineral oil (Zymenol). He was told to report back in seven to 10 days as a more extensive investigation would have to be made if he had not decidedly improved.

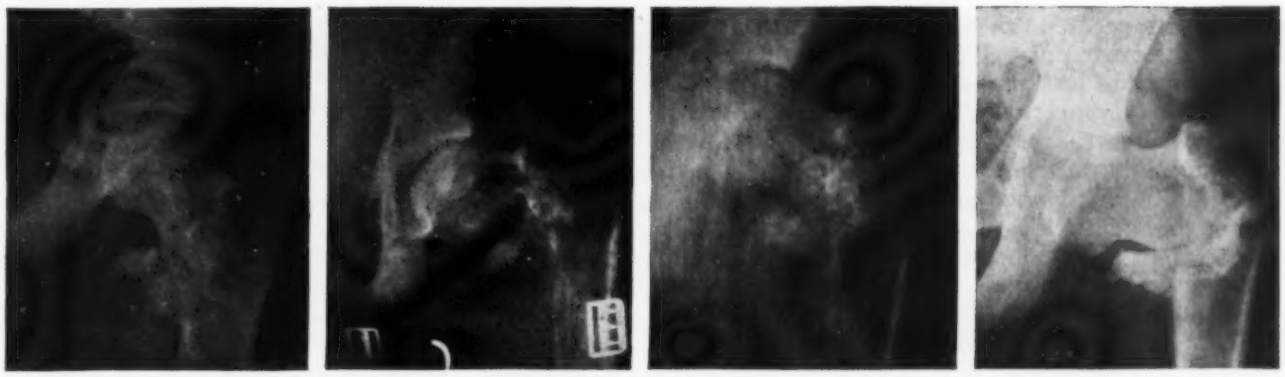
History of Accident

NOTHING was heard of the patient until the morning of January 3, 1936. On this date, two weeks after the original examination, the author was called to attend him at his home because of injury to the left hip in a fall on the slippery sidewalk near his home. Examination at once revealed an evident fracture of the left thigh, and an ambulance was called to remove him to Research Hospital.

Fig. IV is a reproduction of the roentgenogram made on admission. Although photographic reduction has detracted some from the definition of the cortical bone changes, still they may be readily seen in the illustration. The fracture, of course, took place in diseased bone and strictly speaking is a pathological fracture. The cause of the man's underlying trouble was at once suspected, and on this basis, roentgenograms of the right femur and skull were later requested. The changes in the femur and the mottled appearance of the skull may be seen in the reproductions, Figs. V, a, b, and c. The findings of the roentgenologist, Dr. Ira H. Lockwood, are quoted herewith:

"January 3, 1939, No. 32653 — Left Femur.

"A negative of the upper portion of the left femur shows a transverse fracture through the shaft at the site



Figs. VI, VII, VIII, and IX. Fig. VI shows the reduction of the fracture by means of skeletal traction on a Bohler frame. This roentgenogram was made 48 hours after admission. The reduction was accomplished under local anesthetic without difficulty. Fig. VII is a roentgenogram made of left hip and thigh a few days after parathyroidectomy and before any beneficial effects could be expected to reveal themselves in the skeleton. Note that bone atrophy and loss of lime had progressed to a marked degree since January 3. Deformity had resulted from permitting the patient to assume sitting posture after neck operation, and failure to pay as much attention to the fracture as to the interesting systemic developments. Note almost total loss of lime salts in fragments of lesser trochanter. Fig. VIII is a reproduction of roentgenogram made three weeks after that shown in Fig. VII. Position of fragments had been much improved by restoring some traction weights which had been removed, and elevating foot of bed. By comparing the thigh as shown here with that of Fig. VII, it can be seen that even in three weeks' time an appreciable amount of lime had been laid down. Especially noticeable is the new lime in the lesser trochanter. Fig. IX is a reproduction of roentgenogram made nine months after injury. Note the cortex of femur as compared with that shown in Fig. I. Union of the fragments in malposition was partly due to economic forces which required return of patient to his home and partly to his ambition to be up and about too soon in order to use up some of his newly restored energy. He had been at his work for two months, using a cane when walking, when this roentgenogram was made. He limps but has practically no discomfort

of the lesser trochanter which is entirely broken off. There is a good deal of mottling of the shaft of the bone with some decalcification, especially that of parathyroid condition of the bone with the resulting pathological fracture."

"January 5, 1936, No. 32653 — Left Hip.

"Negatives of the region of the left hip and the upper portion of the left femur show a very good apposition and alignment of the fragments of the shaft of the femur. There is some displacement of the lesser trochanter that cannot be improved. If the fragments can be maintained in their present apposition one can anticipate good functional results."

Except for the fracture, physical signs at the time of admission to the hospital were essentially the same as those noted at the time of examination at the office. The following points, as elicited by Dr. F. G. Hidde,* are set down for the sake of completeness:

Physical examination revealed an asthenic, listless adult white male who appeared ill. His voice was high pitched and weak. There was a generalized pallor of his skin and mucous membranes. The skeletal muscles lacked tone and were markedly underdeveloped.

Head normal.

Eyes: pupils were equal and reacted normally to stimuli. Extraocular movements not impaired. Retina appeared normal.

Ears and nose: grossly normal.

Mouth: Teeth are in fair repair. Several have been removed. Tonsils are small and embedded.

Neck: Both lobes of the thyroid gland are just perceptible to palpation and the right lobe appeared to be nodular.

Chest: Funnel deformity of sternum. Expansion is free and bilaterally equal. Breath sounds and vibratory phenomena are physiological. No adventitious sounds.

Heart: No noticeable precordial impulse. No thrills. Area of cardiac dullness is not enlarged to percussion. No functional or organic murmurs.

Abdomen: No tenderness, muscle spasm, palpable masses or enlarged viscera.

Adenopathy: Anterior cervical, axillary, inguinal, epithrochlear nodes soft, discrete, freely movable, non-tender and only slightly enlarged.

Extremities: There was a shortening and outward rotation of the left lower extremity with a fullness about the upper third of the left femur and a suggestive lateral angulation of the femur in this area. All passive motions of the leg produced severe pain in the upper third of the left femur. Other extremities were normal.

Neuro-muscular: Reflexes were generally hypoactive. No abnormal reflexes could be elicited. Sensations were not impaired and all cranial nerves were intact.

Laboratory examination at the time of admission revealed a hemoglobin of 10 grams, red blood cells 3,580,000, white blood cells, 12,500. Urinalysis revealed a specific gravity 1.007, an alkaline reaction and a trace of albumin. Blood chemistry—N.P.N. 73 mgs., uric acid 6.8 mg., creatinine 3.0 mgs., calcium 16.8 mgs., inorganic phosphorus 3.87 mgs., and a carbon dioxide combining power of 56%. Total serum proteins were 7.35%, with serum albumin 4.0% and serum globulin 3.35%. A few days later a phenosulphonphthalein test gave a 35% return of the dye within two hours. A urea clearance test produced a maximum clearance of 22.8 cc. (normal 64-99 cc.).

Operation

BECAUSE of the relative infrequency of deliberate operations for removal of the parathyroids, the technic in this case will be described.

* The author wishes to express his sincere appreciation to Dr. Hidde, who was an intern at the time, for his interest in the case and for his care in collecting and recording data.

On January 21, 1936, under 1% procaine anesthesia, the customary slightly curved, collar incision was made just above the clavicles. The skin flap with platysma was dissected up to the top of the thyroid cartilage. The anterior border of each sternomastoid muscle was exposed.

At this point it was definitely decided to do a thorough removal of all parathyroid tissue found on the right side and, if successful, the left side of

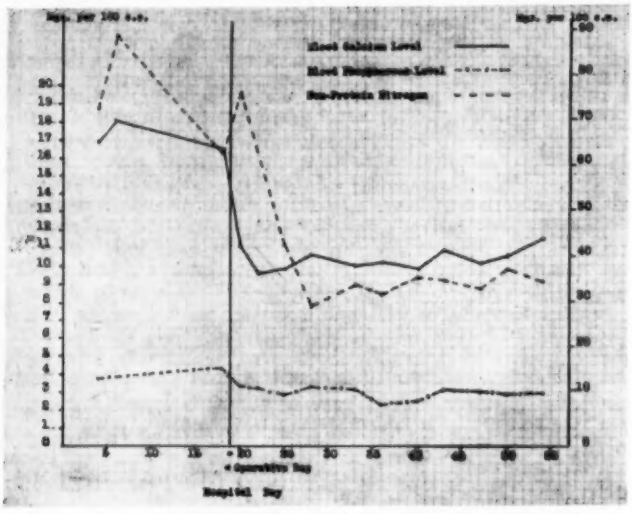


Fig. X. The graph tells its own story of the dramatic drop to normal values after removal of right parathyroids. The figures along right border are for non-protein nitrogen readings. A recheck on August 7, 1936, revealed N.P.N. 31.2, uric acid 4.8, calcium 12.6, inorganic phosphorus 3.1. Blood pressure, which had consistently remained around 145/88 prior to operation has remained below 135/85 since. A very faint trace of albumin is still to be found in some urine specimens

the neck was not to be molested. The right sternomastoid was accordingly retracted, and the ribbon muscles were clamped high in the wound and divided between clamps. An excellent exposure of the anterior surface of the thyroid lobe and isthmus was obtained. The small enlargement which had been felt near the upper pole of the right thyroid lobe was now seen to be merely adenomatous or hyperplastic thyroid tissue.

The internal jugular vein and common carotid artery were retracted and the upper pole of the thyroid was grasped and drawn down. Next the superior thyroid vessels were ligated and this portion of the lobe mobilized. The middle thyroid veins were next divided after pulling the lobe forward and medially. A finger now could be passed completely beneath the right lobe. When the lobe was rolled toward and partially over the trachea, an inspection of the entire postero-lateral aspect of the thyroid could easily be made. Lying upon the loose areolar tissue just behind the upper pole was found a poorly differentiated mass not exceeding 1.0 cm. in circumference, and barely 2 mm. in thickness. It was salmon colored—between a pink and a yellow, and was not identified as a portion of any of the adjacent tissues. It was picked up with a thumb forceps, removed by knife dissection, and placed upon moist gauze for laboratory study later.

Further careful and complete inspection of the posterior aspect of the right thyroid lobe and of its bed failing to reveal anything else of note, and lower pole of the right lobe was extensively mobilized and further inspection carried out.

Our search was soon rewarded by finding a mass of salmon colored parathyroid tissue of what feeling that we could not possibly have accomplished anything beneficial, the pyramidal and adenomatous-appearing portion of the right thyroid lobe were removed. Cross sections made at the time did not seem to promise much in the way of parathyroid inclusions, and, accordingly, the would appear to be normal size and consistency,

Fig. XI. This graph illustrates the decline to normal values of the calcium content of the urine within 24 hours of operation. An interesting feature was the drop in quantity of urine excreted from 3500 cc. to 1500 to 2000 cc. in 24 hours. From micturition frequency of every two hours day and night normal habits were established. In addition, intractable constipation and polydipsia disappeared

with a distinct artery coming into it from the inferior thyroid. The artery was ligated and the parathyroid tissue was dissected from the areolar tissue bed in which it resided. This, and the other two specimens were marked for later identification and sent to the laboratory.

The right lobe was oversewn to bring raw surfaces together, the ribbon muscles were sutured together and the flap of skin and platysma drawn down. A small rubber drain was inserted to the right thyroid field and allowed to issue from between two of the Michel clips used in the skin. Throughout, the patient was most cooperative and his condition was excellent at the conclusion of operation.

Progress

FIGS. X and XI represent in graphic form the changes in the chemistry of blood and urine during the first two months the patient was under observation. Figs. XIII and XIV illustrate the changes over a 30-month period, and response to the second operation done on August 22, 1938.

Patient was dismissed from hospital on March 6, 1936, on crutches, and was seen at the office April 17. He had been feeling fine and was looking very well. Instead of voiding between 5000 and 6000 cc. during a 24-hour period at two-hour intervals, he had had nights when he had not had to

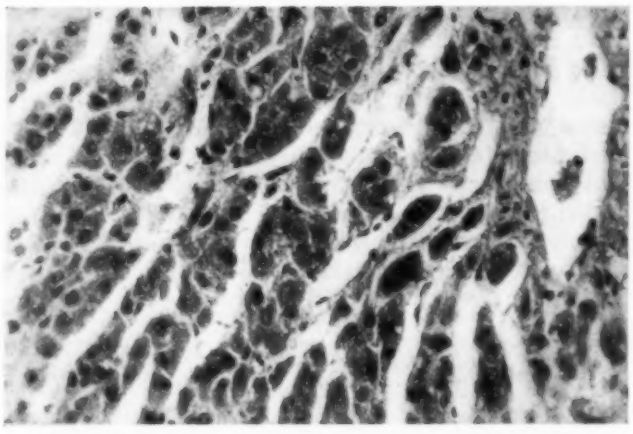


Fig. XII. Photomicrograph of parathyroid removed at first operation

void between 11 P.M. and 4.30 to 5 A.M., and was passing an average of 2750 cc. of urine in 24 hours.

On April 17, 1936, his weight was 157 pounds, the best in years, his hemoglobin had risen to 94% (Dare), and his blood pressure had dropped to 135/90. His appetite was good, he had no aches or pains, and was becoming quite active on crutches. Urine still showed faint trace of albumin, but no casts.

On July 7, 1936, the patient was feeling fine and was able to walk with a limp and get about quite well with a cane. His urine was now free of alubumin and his non-protein nitrogen was remaining within normal range (34.0 mgs. per 100 cc. of blood as compared with readings between 70 and 90 mgs. before operation of January 21, 1936).

On July 13, 1936, patient returned to his work. He had a coxa vara deformity which was compensated for by a cork shoe sole. His limp was only slight and there was no pain, but some tiring on exertion was admitted.

On August 7, 1936, N.P.N. was 31.2, serum calcium was 12.6, inorganic phosphorus was 3.1, sugar was 83.3 and chlorides were 5.36 mgs. per 100 cc. blood. He was feeling well, but suffering from the heat and fatigue to some extent. Urination was slightly more frequent but quantity and urgency had not increased.

During the next two years the patient was admitted to hospital for observation at my request on several occasions to check up on his blood and urine chemistry, and not because he complained. He was, however, noticing some increase in the quantity of urine voided and some shortening of the intervals between micturation. His thighs ached some at nights and his legs and feet ached during the days when he was particularly busy. In the summer of 1937, as figures indicate, his condition was not vastly different objectively and symptomatically from that which obtained prior to the parathyroidectomy of January 21, 1936. The only favorable recordings were of more normal N.P.N. and blood pressure readings. His polydypsia, polyuria, constipation and loss of energy were beginning to return, and in addition, signs and symptoms of peptic ulcer.

Fig. XV was made from the roentgenogram taken at the fourth hour interval and shows the barium retained in a duodenal deformity, and about 50% of the barium meal remaining in the stomach. Approximately the same conditions persisted in the sixth hour study, and a diagnosis of duodenal ulcer was made by Dr. Lockwood. On

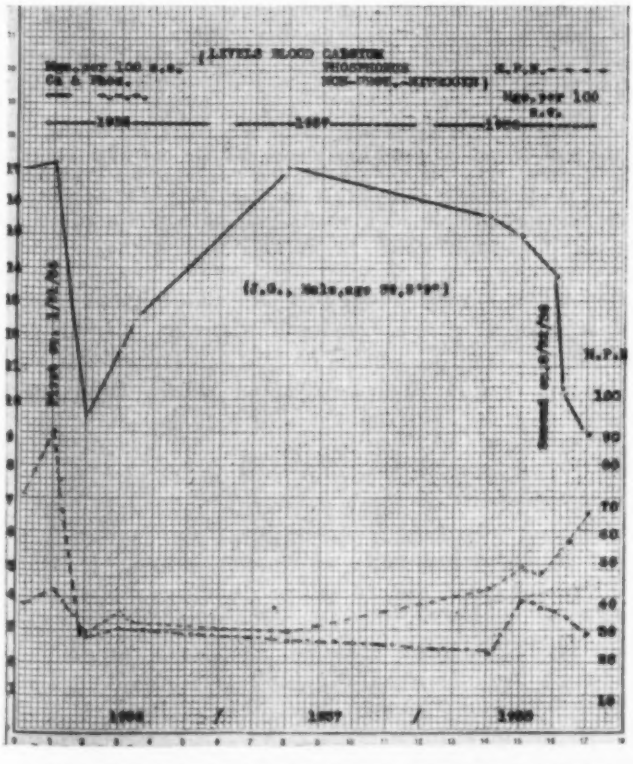
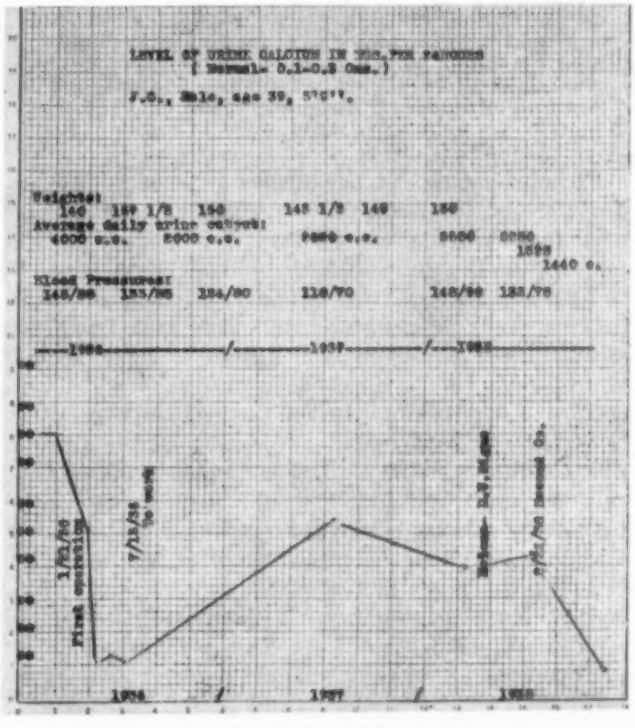


Fig. XIII. Graph illustrating the changes in blood chemistry over a 30-month period, with response to the first and second operation, 1/21/36 and 8/22/38 respectively



No. XIV. Graph illustrating the changes in urine chemistry over a 30-month period, with response of blood pressure, urine voided, and body weight to various operative procedures

the same day (4/26/38) a film was made of the pelvis to show both hips and upper thighs. The right thigh (Fig. XVI) was found to be perfectly normal as far as x-ray appearance was concerned, and is in marked contrast to a film made in 1936 (Fig. V, a). Cystic change in the ischium did, however, appear to be a new and recent development. The left thigh was normal except for the fracture deformity. Both thigh bones had normal-appearing texture, and the cortex of each was of proper density.

Fig. XV. Roentgenogram of April 26, 1938, made at the fourth-hour interval showing the barium retained in a duodenal deformity and about 50% of the barium meal remaining in the stomach. Approximately the same conditions persisted in the 6th-hour study, and a diagnosis of duodenal ulcer was made by Dr. Lockwood

From the time of this study in April, 1938, to July, 1938, efforts to relieve the ulcer symptoms by diet and antacids were slowly succeeding at the expense of his general well-being. On August 15 the patient came to my office to express his willingness to have a small mass removed from the site of his right thyroid remnant if I thought it would help him to improve in energy, weight, and comfort. I explained to the patient that the mass he could palpate, which was not larger than a plum stone, was probably just a degenerated thyroid remnant and that I would only operate if he permitted me to remove any excess parathyroid and thyroid tissue he might have on the left side. He readily consented, was admitted again to Research Hospital on August 20 and operated on August 22, 1938.

The second operation was done without any preliminary calcium injection and under 1% procaine anesthesia. The usual goiter incision and dissection were carried out with bilateral division of the ribbon muscles. The right thyroid remnant was completely removed and a careful inspection made for any remnant of parathyroid tissue, but none was found. The left portion of the thyroid gland was next examined and found to be made up of a normal appearing lobe with a duplicate, thinner lobe just beneath and behind it, closely attached to which was a rather large parathyroid gland. The inferior parathyroid was easily located and was also definitely enlarged as compared with those removed in 1936 and with the left superior parathyroid. The two parathyroids, and about two-thirds of the left thyroid lobes were removed and

Fig. XVI. Roentgenogram of the right thigh made April 26, 1938, showing a practically normal bone texture. The ischium, however, contains an area of bone absorption and cyst formation, — a development of recent date in all probability, and a factor in deciding upon the second operation

the raw surfaces oversewn. The wound was closed and drained in conventional manner and the patient returned to bed in excellent condition.

From August 22 to September 1, 1938, the events were at least as dramatic as those of 1936. As the graphs show, the serum calcium dropped at once from pre-operative readings of 14.8 and 15.5 mgs. to 8.8 mgs. The urine calcium dropped promptly also, and the 24-hour specimen completed on August 26 contained .056 gms. in the 1440 cc. (normal 0.1 to 0.3 gms. per 24 hours). The N.P.N. rose to 64.6 on the fourth postoperative day; uric acid was 5.0 and creatinine was 3.3, inorganic phosphorus was 2.9 mgs. (normal 3.7 to 5 mgs.) sugar was 91.7 and chlorides 5.28 gms. per liter of blood.

Urine specimens taken between the day of operation and September 1, 1938, showed average 24-hour voidings ranging between 1325 and 1440 cc., from a faint trace to a moderate trace of albumin, alkaline reaction (pre-operative acid) and

containing varying quantities of finely and coarsely granular casts. The specific gravity ranged between 1.004 and 1.008 as before operation.

There was no frank tetany until the fifth day and this manifested itself in what the patient described as "quiverings" about the palm near the wrist, about the heels, and a "twitching feeling" in the thigh muscles. He was found shaving another patient in the ward on the fourth postoperative day and was difficult to restrain after the first

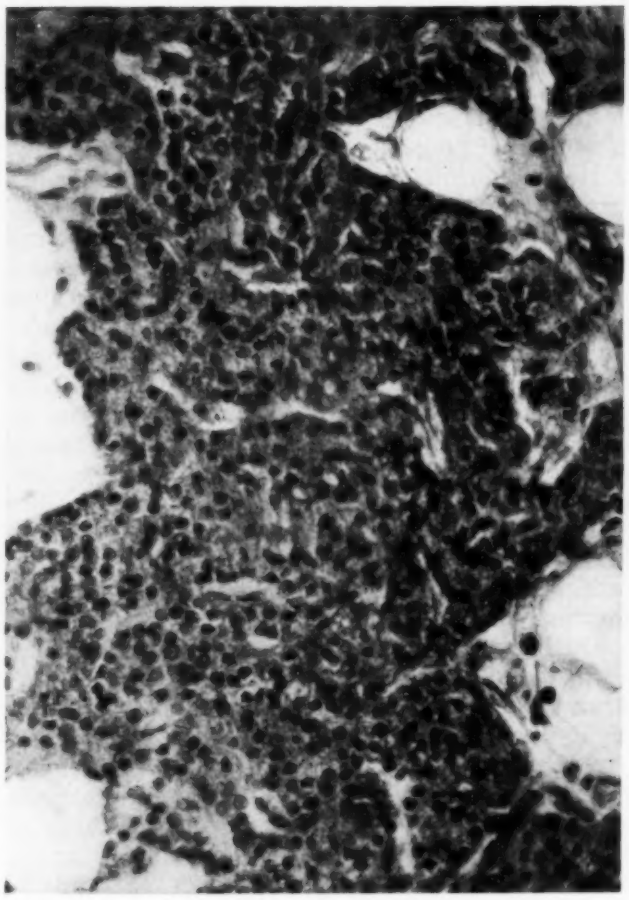


Fig. XVII. Photomicrograph showing the appearance of the parathyroid tissue containing a preponderance of the oxyphylic type of cells and only a few chief cells

day. He has not had such freedom from thirst and polyuria for years as he has enjoyed since August 22, 1938. He has gone from 9 P.M. to 6:30 A.M. without voiding, and from 6:30 A.M. to noon,—thus voiding on the average of every six hours day and night. He has gained four and a half pounds in weight during the first 10 days postoperative and his pulse ranged around 72, with blood pressure 110/70. His wound healed by primary intention.

He returned to his work on Tuesday, September 5, and has reported at intervals of several days for me to observe him since. He has been encouraged to eat a bland, mixed diet and has taken milk in good quantity, but has not thus far been given any medication except a few hypodermic injections of morphine to relieve pain and restlessness during the first 36 hours after operation. He reports feeling fine, sleeping all night and having more energy than he has been accustomed to.

The pathologist, F. C. Narr, reports as follows upon the tissue removed at operation of August 22, 1938:

"J. G., No. 113322 — Clinical diagnosis: Thyroid hyperplasia; hyperparathyroidism.

"Specimen labeled 'left thyroid' measures 3 x 2.5 x 2 cm. It consists of a soft mass of irregular, stringy tissue, some strings red, some white. It does not resemble normal thyroid tissue.

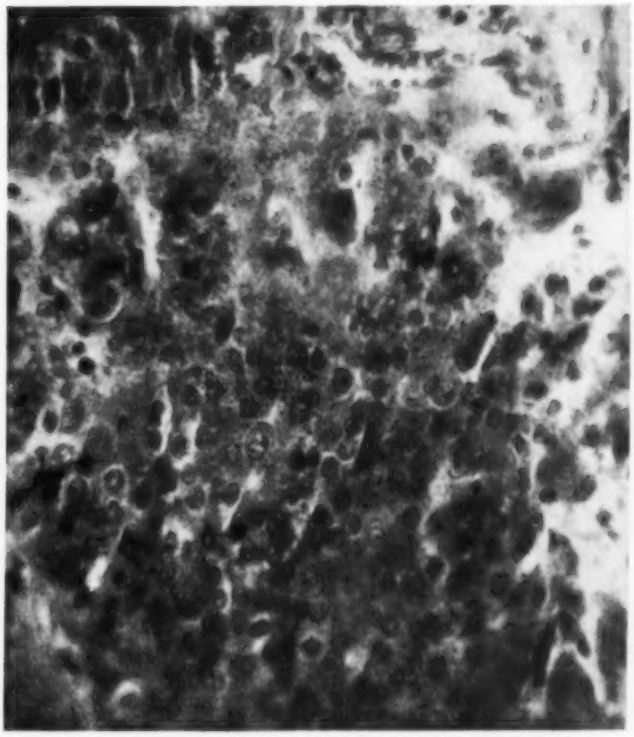


Fig. XVIII. Made at the same magnification as in Fig. XVII showing microscopic appearance of cells in another nodule of parathyroid. It will be noted that there are cellular hypertrophy, lobulation, vacuolation and other changes present

"Specimen labeled 'right thyroid' measures 4 x 2.5 x 1.5 cm. It is a reddish, meat-like structure partially divided by septa into three lobes and is covered by a tough translucent capsule. Cut section reveals beefsteak-like, reddish, fairly homogeneous tissue.

"Specimen labeled 'left superior parathyroid' measures 1.2 cm. in length and 0.2 cm. in diameter. It is a soft, yellowish object which resembles fat. One end is slightly hemorrhagic and the consistency differs from the rest of the surface.

"Specimen labeled 'left inferior parathyroid' consists of two pieces of tissue. The larger measures 0.8 cm. in length and 0.4 cm. One end is fatty, similar to the first specimen examined. The other is whitish and slightly hemorrhagic. It measures 0.2 cm. in diameter and consists mostly of fat, but there is a small amount of whitish tissue adherent.

"Microscopic: Sections of right thyroid show an increase of fibrous tissue. The acini are quite uniform in size, filled with colloid and lined with low cuboidal epithelium.

"Sections of parathyroids show typical parathyroid tissue with few fibrous trabeculae. The cells are quite uniform in size and shape. The majority are of the acidophillic (oxyphilic) type with only an occasional chief cell present." (Fig. XVII).

"In the section labeled 'left thyroid' there is parathyroid tissue. It has some hemorrhage and phagocytic cells containing a brown granular pigment (hemosiderin).

There are also such blood pigment containing cells in the fibrous capsule which surrounds the parathyroid and appears to be part of the capsule of the attached thyroid. The cells of this parathyroid nodule are large, hypertrophic. There are more of the chief cells present. At places one sees occasionally acidophilic cells which are columnar." Fig. XVIII, showing the microscopic picture if this parathyroid nodule, was made at the same magnification as that shown in Fig. XVII.

"Diagnosis: Hypertrophy parathyroid; Hemorrhage parathyroid."

Discussion

SINCE pain in the lower extremities, loss of muscle strength, general weakness, and lassitude, and frequently fractures, are common accompaniments of the disease under discussion, and since it occurs in the middle decades of life (males about 30% and in the 40's; females over 60% and

Fig. XIX. Positive of roentgenogram made of ischium of Case 2 on January 27, 1939, showing definite effect of operation upon redisposition of lime salts in rarefied area (See Fig. XVI)

in the 50's), it is certainly a cause of disability to be considered in industry. This is especially true when factory employment is considered, inasmuch as statistics seem to show a preponderance of the disease in localities where smoke, fog or haze obscure the sun; where indoor life and lack of proper calcium-containing food prevail. Other factors in the history of a given case which should lead us to suspect the possibility of hyperparathyroidism are, the occurrence of renal colic (18 of 135 cases), polyuria and extreme constipation. As Dr. Krahl and others have noted, there may be an abhorrence for salty food.

As regards signs which might direct one's attention toward a correct diagnosis, perhaps the occurrence of a fracture at a site shown later by x-ray to be typically affected by osteitis fibrosa cystica, should be given most prominence. Next might be listed in order, palpable tumor (often found later to be thyroid), blood chemical and urinary findings, x-ray evidence of diffuse calcific deposits in the kidneys, and bone changes discovered without regard to fractures, i.e., rarification, cysts, generalized osteoporosis, cortical changes, and, as in one of the cases here reported, bending of decalcified bones.

Conditions not truly a part of the syndrome under consideration, but to be ruled out, are the following: Diabetes insipidus, osteomalacia, rickets, calcinosis universalis, scleroderma, gout, ankylosing polyarthritis, nephrolithiasis, osteitis deformans, malignant bone tumors, localized fibrous osteitis—even Addison's disease and neurasthenia.

We do not feel that we are presuming too much upon Wilder and Howell when we say that a fourth criterion might well be the relief of symptoms and signs of hyperparathyroidism in cases coming to operation as shown by chemical studies of blood and urine, and subjective and objective restoration of normal physiology. We feel this despite the possibility that time may see a return of abnormal physiology by reason of the assumption of abnormal or hypersecretory function by remaining parathyroid tissue in our own patient.

Of the various theories regarding the development of parathyroid hyperplasia and adenoma, the most probable appears to us to be that of vitamin D deficiency causing proliferation of parathyroid tissue just as iodin deficiency produces thyroid proliferation. Cell nests susceptible to stimulation develop into adenoma when vitamin D is deficient. The adenoma takes up the activities of the parathyroid system, and no hypertrophy or hyperplasia of the other glands occur. Removal of a parathyroid adenoma results often in tetany which is likely to persist to some degree until resting glands assume function, or until parathormone or dihydrotachysterol is administered.

Much work upon chronic arthritis is being done abroad, and Schkurov, working upon the idea propounded by Oppel in 1929, was able to report only eight failures in 116 cases of chronic polyarthritis and spondylarthritis in whom parathyroidectomy had been done. Workers in allergy and the synovial reactions incident thereto, and experimental workers in parathyroid physiology and surgery, may yet prove to be a boon to workers in industry, for there is no doubt of the large incidence of disability from arthritis and allied conditions.

Of the two cases here reported, one had developed to an almost hopeless state and had been through the hands of experienced clinicians before the true nature of the condition was suspected. In the case of the other patient, a chance fall on a slippery pavement revealed the condition causing a disability which had no doubt existed for eight or nine years and might easily have persisted unrecognized for many more years. It is cases and facts such as these which make their presentation appear to have merit. Because of the undoubted existence of many unrecognized cases of hyperparathyroidism, case reports and experimental data bearing upon the subject cannot be too widely disseminated.

The essayist wishes to refer all those interested in this most interesting disease to the recent (1935) outstanding monograph, "The Parathyroids in Health and in Disease," by David H. Shelling, of Baltimore, for it is not the intent of this presentation to cover the broader aspects of physiology,

of pathology, or of therapy. The current literature gives evidence of wide interest in the disease and is sure to cause more careful scrutiny of our patients exhibiting such minor but persistent complaints as weakness, loss of appetite, loss of weight, flat feet, muscle and joint pains, vague abdominal pain, anemia, lumps and deformities of bones—especially of the long bones and the jaw (epulides), bloody or milky urine, renal colic, lumbago, and last, but most revealing of all, any tendency to spontaneous fractures.

As Shelling has said: "Whatever meager information has accumulated about these glandules is due to the efforts of individual investigators who were attracted to the study of parathyroids by the presence of tetany, calcinosis, or defective osseous and dental development . . ." that, "Unlike other organs in the body, the parathyroids have been neglected by the general pathologist." This being undoubtedly true, it behooves us to be conscious of a certain small incidence of the disease among the chronic complainers in industry and in private practice. Much remains to be learned about this group of glands, variable in number, inconstant in location, and so tied in with other physical and chemical relationships that compensation for over- and for under-activity are, to say the least, mysterious. Thus, it has been shown that the most severe cases of osteitis fibrosa cystica may be accompanied by very moderate hypertrophy or hyperplasia of the parathyroids, while large adenomatous glands may exist with comparatively little osseous change.

It might be well to call attention to the confusion existing in some texts as to nomenclature with reference to bone cysts. Older texts, of course do not recognize the connection between hyperparathyroidism and demineralization of bone, bone cysts and certain giant cell tumors of bone.

Finally, in our enthusiasm to clear up doubts as to the cause of mysterious fatigue, flat foot symptoms, and polyuria, let us not be too anxious to sacrifice parathyroid tissue in the absence of the characteristic bone and blood chemical criteria. In Case 2, reported above,* we feel that with all the positive evidence of hyperparathyroid disease, we may not even yet have cured our patient through surgery. But we do have the satisfaction of knowing that diet, drug and x-ray therapy have never scored a cure while surgery has many to its credit—is almost a specific.

Comment

INDUSTRIAL organization has reached such a point in its development that provision of facilities for the preservation of the health of the worker is taken as a matter of course. Facilities for the care of those disabled in industry are on a par with, or superior to, those available to the general public. These facts being generally accepted as true, it is unlikely that any typical case of hyperparathyroidism, cared for in a modern hospital with trained x-ray and laboratory staffs, would be overlooked if the attending physician considered its possible existence, and ordered x-ray study of the long bones and complete blood chemistry studies.

The two cases here presented of individuals in the prime of life rendered incapable of carrying on because of an endocrine dysfunction susceptible of relief or cure if discovered, and doomed if undiscovered, should spur us to renewed efforts in the search for similar cases. No doubt many cases never achieve a diagnosis because of the vagueness of the symptoms and their mimicry of several minor complaints seldom requiring hospital care, detailed laboratory study or x-ray. If our presentation encourages others to seek out this interesting disease as a possible cause of disability, or if a single new worker can be recruited for the search for a missing link in the chain of events leading up to disabling bone pathology or asthenia, we shall feel well repaid.

*Since submission of this report for publication, the case of J. G. (Case 2) has been followed carefully. After a short period of mild tetany, the patient showed a restoration of health which is best illustrated by his statement to the effect that he felt better than he had in 15 years. Subjective and objective findings indicate a cure.

The Endocrines in Heart Disease

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Chicago, Illinois

ENDOCRINE disorders are not the most important factor in heart disease, nor is this the field in which the endocrinologist is of greatest service to the railroads. However, some cases of heart disease do have an endocrine factor, the recognition and proper treatment of which is essential to the patient's speedy and complete recovery.

Probably the first thought in this connection is the cardiac disorders associated with thyroid disturbances. Paroxysmal tachycardia is sometimes an early sign of exophthalmic goiter. Its occurrence is not pathognomonic of Graves' disease but should always lead to a search for other signs of this syndrome. Please note the word "syndrome" because I do not believe that Graves' disease, or exophthalmic goiter, is always or primarily a disease of the thyroid. The eventual heart damage is an end-product of hyperthyroidism too well known to merit discussion.

The irregularities of cardiac rhythm, particularly auricular fibrillation, are associated more commonly with toxic adenoma than with other forms of hyperthyroidism. The importance of this lies in the fact that their connection with the thyroid disturbance is sometimes overlooked. In those cases the condition is handled primarily as a cardiac affair and treatment directed at the heart itself—digitalis, diuretics, etc. The patient sometimes presents a picture of cardiac insufficiency—

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irregularity, edema, dyspnea, enlarged liver, etc. A small adenoma may be overlooked or not properly appreciated. Treatment is more effective when designed to correct the thyroid disturbance.

My own feeling is that adenoma with hyperthyroidism is not the same syndrome as diffuse exophthalmic goiter. The adenoma is usually a surgical condition best and most speedily controlled by removal of the adenoma or partial resection of the thyroid. Graves' disease is often better handled by some other measures.

In adenoma irregularities auricular fibrillation often occurs, while in Graves' disease the tachycardia is the outstanding feature. Signs of decompensation occur later.

Cardiovascular damage, hypertension and signs of decompensation are much more common in the adenomatous type of goiter. This may, of course, be due to the more prolonged course of the adenoma before it comes to adequate treatment. One frequently sees such cases with a history of recurrent attacks running back over a period of 30 years. Through many of these attacks the cardiac symptoms are often the most prominent.

Occasionally a patient with a definite adenoma complains of precordial pain, the cause of which cannot be determined. A diagnosis of hyperthyroidism cannot be made. The pulse is a high normal, the basal metabolic rate normal or slightly below. Eventually these cases develop attacks of paroxysmal tachycardia, the basal metabolic rate goes up and the diagnosis of mild hyperthyroidism can be made. Control of the hyperthyroidism is accompanied by complete relief of precordial pain.

Myxedema, and probably lesser degrees of hypothyroidism, are associated with a condition called "myxedema heart." This is characterized by sluggish heart action, slow pulse rate, shortness of breath, cyanosis, pitting edema, rales at the base of the lungs, enlargement of the liver and heart, low amplitude of the P and T waves in the electrocardiogram. The enlargement is said to be due to dilatation and myxedematous infiltration of the heart muscle.[1]

SYMPTOMS in these cases do not respond to digitalis and diuretics. They are relieved by appropriate doses of desiccated thyroid. The heart decreases in size and signs of decompensation disappear. The electrocardiogram returns to normal.

The dosage of thyroid needs to be carefully watched. One should begin with small doses not to exceed one grain per day. The dose should not be increased oftener than once every five days and then by no more than ½ grain per day.

The administration of thyroid is said to increase the work faster than the strength of the heart, and anginal attacks occur because the narrowed coronaries are inadequate for the increased work. Means and Richardson[2] noted that angina pectoris can be produced in myxedematous subjects by too rapid thyroidization. They cite one case in which a maintenance dose only large enough to keep the basal metabolism at minus 15% had to be employed. If it was maintained at a higher level, he suffered from angina on effort.

The danger of using desiccated thyroid has been greatly over-estimated. I agree with those who feel that it should not be bought except on a physician's prescription, but in the hands of a careful doctor it is a valuable therapeutic agent.

Thyroidectomy for decompensation never squared well with common sense and now happily seems on the way to the discard as a therapeutic measure in this condition.

Parathyroid extract has been used successfully as a diuretic by McCann.[3] His patients were edematous with a low output of urine, a low return of phenolsulphonephthalein and a low output of chlorides. The blood calcium was also a little below normal. In one case, following the injection of 10 units of parathormone, the diuresis continued from March 13 until April 2 when a second injection of 10 units was given with subsequent diuresis until April 25. The output of the dye was increased and there was also a great increase in excretion of chlorides. To another case he gave 20 units followed by two subsequent doses of 40 units each. These were followed by an increased output of urine and a greatly increased output of chlorides with a reduction in the edema. All of these patients had generalized edema with severe disturbance of renal function. The total protein of the serum was low and the blood calcium was below the normal minimal level. No bad effects were noted following the administration of this.

Cardiac disturbances are sometimes associated with adrenal disorders. In Addison's disease precordial pain and tachycardia are usual. Low blood pressure is not constant, but is the rule. Some cases experience a fall in blood pressure when changing position from lying to standing. This is said to be associated with an increase in pulse rate and a decrease in pulse pressure.

Cardiac symptoms are sometimes seen in less severe forms, as illustrated by the following case:

A fireman, aged 36, first seen about 10 years ago, complained of attacks of weakness, in which his heart "skipped some beats," epigastric fullness and nausea without vomiting, extreme sensitiveness to cold, loss of weight (10 pounds), palpitation, dyspnea and nervousness. He had been carefully studied in the hospital and outpatient department. The diagnoses suggested were neurocirculatory asthenia, early coronary disease and duodenal ulcer. Height 5 feet 7¼ inches; pulse 68, blood pressure 85/55; slight pigmentation; basal metabolic rate minus 14%. The diagnosis was adrenal insufficiency, probably secondary to an old tuberculous infection.

Treatment consisted of suprarenal by mouth with small gradually increasing doses of tuberculin. His spells soon stopped entirely and his heart became regular. Weight increased and his improvement was generally satisfactory until three years later when he had a diarrhea and a fever of seven weeks' duration, the cause of which was not

determined. After this there was some recurrence of symptoms, which cleared up on further medication. He has felt quite well physically ever since and has become an ardent New Dealer.

The suggestive features of this case were the height, the low blood pressure, the slow pulse, the low metabolic rate and the lack of any definite non-endocrine condition to explain his symptoms.

Tumors of chromaffin tissue have been found associated with hypertension which is usually paroxysmal. During the paroxysms symptoms occur which resemble those produced by large doses of adrenalin, such as elevation of blood pressure, precordial discomfort, occipital headache, choking sensations, nausea, vomiting, cold clammy extremities and attacks of coughing with frothy, blood-tinged expectoration.[4]

Intracardiac injections of adrenalin enjoyed wide popularity in the lay press a few years ago. It is a measure that should be remembered, but unfortunately the equipment for this procedure is not likely to be available when most needed.

Injections of adrenalin, 1 cc. of 1:1000 solution of adrenalin, are said by Levine[5] to be helpful in the differentiation of true angina pectoris from conditions which simulate it. In true angina a typical attack accompanied by an increase in systolic blood pressure, pulse pressure and pulse rate is said to occur immediately after the injection. This does not occur in other conditions. While no bad results are said to have followed this procedure, it appears to be not without some danger.

Maliner[6] injects from 3 to 13 minims of adrenalin chloride 1:1000 solution in doses of approximately 0.01 to 0.15 mgs. per pound of body weight. This test apparently serves to emphasize the intensity of the murmur and to better localize the areas over which it can be heard and so appears to be of material assistance in the study of heart murmur. The author's conclusions are: It will:

"1. Intensify the normal sounds of the heart.

"2. Intensify the murmurs of valvular lesions.

"3. Localize these murmurs in their valves.

"4. Cause a disappearance of non-pathological murmurs, or tend to localize them to a functional area.

"5. Bring out valvular lesions of supposedly cured cases and so be useful before discharging a case.

"6. Cause an initial weakness of heart sounds and murmurs in those which have a myocardial weakness."

Stokes-Adams syndrome is said to be relieved by injections of adrenalin (10 minims). Doses should be repeated as needed, usually about every four hours, but they may be given hourly if the symptoms are not promptly relieved. Subcutaneous injection of 0.3 to 0.6 cc. of 1:1000 solution is recommended as a safe and effective dose, but intravenous use may lead to grave reactions.[7]

Josue[8] noted that in deaths reported as due to myocarditis, autopsy often showed the heart muscle to be in good condition, even hypertrophied. In 1916 he reported four cases of death apparently from cardiac insufficiency in which at autopsy the myocardium was found quite strong and the suprarenal glands very small or diseased. He says that in such cases there is often complete arrhythmia with some dyspnea and that Sergent's white line is generally present. He called this type of case "asystolie surrenale." In treatment better results are said to follow the administration of the whole suprarenal gland rather than epinephrine alone. Adrenal therapy should be considered in those cases of myocarditis which exhibit low blood pressure, asthenia, an enlarged heart and Sergent's white line.

The pituitary rarely plays a prominent part in cardiac disturbances. Cushing's[9] cases of basophilism, associated as they were with hypertension, undoubtedly sooner or later would have presented signs of heart strain. However, that would have been a late sign and treatment would be directed at the underlying disorder. The same syndrome is sometimes associated with tumor of the adrenal cortex.

Simmond's disease is accompanied by a small heart, a fall in blood pressure and signs of a failing circulation. Simmond's disease is a very rare entity, and the cardiac features of it are not of great significance. Lesser grades of pituitary deficiency are associated with Addison's disease and less severe forms of adrenal damage. The close functional relationship of the adrenals and the pituitary is such that hypoadrenia will always be better treated if we pay attention to the pituitary deficiency usually a part of the picture.

The association of pituitary and thyroid dyscrasia with cardiac symptoms is shown by our experience with an Illinois Central engineer. Mr. L, aged 72, complained of dyspnea and swelling of his feet for three years with pain and swelling of his abdomen for one year; vertigo and spots before his eyes and headache for the past few months. Diurnal somnolence was marked. Examination showed obesity (weight 222 pounds) of the thyropituitary pattern, distant heart tones with a systolic murmur over the aortic area, liver tenderness and a partial ventral hernia, narrow palpebral fissures, thin eyebrows and brittle nails. The blood pressure was right 186/90, left 180/80. There was a trace of albumen in the urine. Blood uric acid 5.5 mg.; cholesterol 195 mg. The basal metabolic rates had been minus 9.6% and plus 7%. The diagnosis was hypertensive heart disease.

He was treated at first by rest, reduction diet and digitalis. This had no favorable effect on his complaints. Later, because of his obesity, diurnal somnolence, mental retardation, narrowing of the palpebral fissures, thin eyebrows, high uric acid and cholesterol, it was thought that he had a thyroid and pituitary deficiency. He was consequently given 5 minims of pituitrin. This was followed in the next 40 minutes by a fall in blood pressure from 184/84 to 144/60. The following day the injection of 5 minims of antuitrin had a similar effect. He was then given 5 minims each of antuitrin (not antuitrin-S) and pituitrin daily, and one

grain of thyroid per day. On this regime his blood pressure dropped to 125/80, his edema and symptoms were relieved and he lost 35 pounds.

Status thymicolymphaticus is a condition discussed much more freely by the pathologists than it is by the clinicians. Curiously, the pediatricians seem less disturbed by the enlarged thymus than does any one else. There are a good many who doubt that an enlarged thymus is responsible for the sudden death which sometimes occurs in infants under anesthesia or other strain. The fact that the pathologists are so sure of this syndrome should make the clinicians slow to deny its frequent existence. Ray[10] pointed out the fragile cardiavascular system that is found in this condition and the fact that persons who are victims of it should be warned against undue strain and protected against shocks.

It appears that phenomena observed following irradiation are almost identical with those reported to follow splanchnicectomy, adrenal denervation and celiac ganglionectomy. We have seen a few cases subjected to both procedures. Where one failed, the other appeared to be equally unsuccessful. However, irradiation can be carried on indefinitely and some patients seem to be kept on a better basis by so doing. It seems to have this advantage over the surgical treatment of hypertension. There is no danger accompanying it, no mortality, no hospitalization. It should be used much more widely than it is at present.

In this connection it is interesting to recall that Raab,[11] of Vienna, advised irradiation of the adrenals for the relief of attacks of angina. He used 180 kilovolts, 4 milliamperes, 0.5 mm. copper and 1 mm. aluminum filter, delivering 200 roentgens to the adrenals at each treatment of which he gave three—a total of 600 roentgens to each adrenal. He reported 40 of 58 cases either considerably improved or entirely free from complaints.

Our patients noted relief of precordial distress after receiving a few treatments of 50 roentgens each to the adrenals.

FOR several years we have been interested in the treatment of essential hypertension by irradiation of the pituitary and adrenals. Many of these patients exhibit some cardiac symptoms, particularly heart consciousness, palpitation and precordial distress. These were in most cases relieved by irradiation of the pituitary and adrenals. The symptomatic relief in such cases was more striking than the reduction in blood pressure and sometimes occurred independently of it. Our experience has been as follows:

Hypertension			
Adequately treated			277
Improved	191	68.95%	
Relapsed	29	10.47%	
Remained improved	162	58.48%	
Unimproved	86	31.04%	
Insufficient treatment			63
Couldn't be followed			27
			367

Hypertension and Diabetes	
Improved as to both conditions	13
Improved as to hypertension only	7
Improved as to diabetes only	4
Improved but relapsed	1
Unimproved	2
Insufficient treatment	6
Couldn't be followed	1
	34

Hypertension Cases of Other Men	Cases	Cases Improved
Martin	100	80
Baker	40	30
McGuffin	40	30
Boswell	12	11
Finch	12	9
Konantz	6	3
Parkhurst	5	3
Hadley	4	4
Miscellaneous	56	47
	275	217

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Florida Association

AT THE pre-convention meeting of officers and committee chairmen of the Florida Association of Industrial Surgeons in January, it was decided to hold the Annual Meeting of the Association at the Tampa Terrace Hotel, Tampa, Florida, on April 29, 1940, preceding the Annual Meeting of the Florida Medical Association.

Tuberculosis Case-Finding

—*With Special Reference to Hospital Employees*—

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TODAY case-finding of tuberculosis in adults is more complex than ever because we now see on chest films lesions in a stage of development never seen in previous years. We have new diagnostic problems because of the combination of three factors: first, we are doing roentgen case-finding; secondly, roentgen technique has progressed; thirdly, young adults, from the standpoint of tuberculosis, are different from otherwise similar groups of a generation ago. About 8,000 hospital employees in New York City have been periodically examined by roentgenograms during the last four years and I have reviewed all the tuberculous lesions found. A brief resumé of some well-known principles of mass case-finding of tuberculosis is necessary before discussing the significance of some of these lesions.

In the last two decades in the United States the number of children with a primary infection has decreased, especially in some rural communities, so that the majority of children now reach adolescence without any primary infection. Where this is the case, tuberculin sensitivity tests simplify case-finding because the complete examination may be limited to the minority of children who are tuberculin positive. Of course, only very few of those who are tuberculin positive (those who at some time have had a primary infection) have any clinical tuberculosis. The point is that practically all cases of clinical tuberculosis will be found among the tuberculin positive children.

Although the proportion of negative reactors among young adults is greater today than a generation ago, the percentage still is not sufficiently large to make tuberculin testing alone a valuable "sieve" or "screen" in case-finding among adults. For other reasons, also, case-finding by routine roentgenograms is being used more each year. Though possible, it is rare for a clinical pulmonary lesion not to show on a good film. There are parts of the lungs, the portions in front and behind the mediastinal shadow and the portion extending into the diaphragmatic sulci, which do not ordinarily show on a roentgenogram. Fortunately, early clinical (secondary) tuberculous lesions seldom localize in these parts. Roentgenography of the chest has developed to the point where a tuberculous lesion can be visualized before that lesion gives rise to any physical signs or symptoms. This offers the long sought opportunity to treat the disease in its earliest stages when therapy is most effective.

In roentgen case-finding among apparently healthy adults many of the films will show healed tuberculous lesions of various kinds. A common finding is the typical Ghon nodule. This is a dense shadow, usually rounded and less than a centimeter in diameter, with well demarcated edges. This is all that remains visible of the first infection of that individual. When observed over a period of months, its appearance does not change. For the physician doing case-finding, these Ghon nodules have little importance, for they are easily distinguished from the shadows of early clinical tuberculosis. Instead of the typical Ghon nodule, the primary lesion may have left a wraith-like strand or a small aggregation of calcific dots.

There are other roentgen shadows indicative of healed tuberculosis. Areas of fibrosis or of healed calcified caseation may be seen; also pleural thickening or adhesion (apical, costal, interlobar or diaphragmatic). In the hilar or mediastinal area there may be enlargement or irregularities of outline or spots of increased density indicative of healed tuberculous hilar adenitis.

Localized non-tuberculous penumonitis may be seen in some films. The experienced industrial physician taking routine films when an employee returns to work after a few days out with a "cold," is no longer surprised at the frequency with which such small areas of pneumonitis are found. In mass case-finding surveys such penumonitis cases are encountered, though less frequently. A nonspecific pneumonitis may resemble a tuberculous lesion so closely in location, density and outline, that the differentiation can be established only after repeated examinations. When the physician first encounters these pneumonitis lesions, he tends to assume, by analogy to pneumonia, that such shadows will disappear in a couple of weeks. Unfortunately for the diagnostician they may persist for weeks, though the patient is free of all symptoms except anxiety to have the diagnosis established quickly. Cystic disease, various forms of pneumoconiosis, pulmonary infarction, interlobar or encapsulated effusions, abscess, primary or metastatic neoplasms and localized bronchiectasis, require differentiation. Change in the chest film may result from cardiovascular disease which, on the film alone, may be difficult to differentiate from tuberculosis. Anatomical variations may produce unusual shadows. Old cervical adenitis and abnormalities of the chest wall such as callus of an old fractured rib or a localized collection of pigment in the skin may accurately simulate a lesion of the lung.

When a positive film is found the physical examination and laboratory tests must be conscientiously performed. When other criteria of diagnosis fail, the "prospect" is re-examined at intervals. In differentiating active tuberculosis from healed lesions, fibrotic and calcified areas, much reliance is placed on the changes in appearance of the lesion during the interval, especially change in size. A lesion increasing in area must be the result of an active process.

On some films, the diagnosis of pulmonary tuberculosis is easy. This has given rise to the false impression that it is usually easy and that in the exceptional cases one need only show the

films to a consultant to settle the question. This is not true, and these ideas must be eliminated from all minds before roentgen case-finding can assume its proper place in the forefront of tuberculosis eradication. Films must be evaluated accurately and some cases may require painstaking, clinical study and continued observation. The single roentgen film tells us only this: There is some tissue in that chest which is either more or less opaque to roentgen rays than is the normal lung tissue in that area. The function of the physician *begins* with this finding; by itself an area of increased density is meaningless and if a wrong meaning is attached to it much harm may be done. In roentgen case-finding when we discover a symptomless small lung lesion in an apparently healthy person, we may have rendered him a priceless service. This service was not done by case-finding alone but in combination with the subsequent careful study to demonstrate that the lesion was in fact tuberculous and indeed active. This latter is the more difficult but an essential part of case-finding.

This brief discussion is solely to remind us of difficulties which we have all met. Routine roentgenography is a valuable procedure *provided those with positive films are subjected to painstaking individualized diagnosis.* We must be prepared, therefore, to differentiate between:

1. Active tuberculosis.
2. Healed tuberculosis.
3. Non-tuberculous lesions; healed or active.
4. Anatomical variations.
5. Extra-pulmonary conditions producing unusual shadows.

Among adults, for practical purposes, this was the whole of the diagnostic problem till a decade ago. Why is the diagnostic problem different today? Because Naegeli's dictum — everyone has had a little tuberculosis — was literally true in 1900. Tuberculin tests a quarter century or more ago established the fact that infection by tubercle bacilli was the common lot of the adult human race. Today, in contrast to previous generations, many persons reach adult life without having had *any* tuberculosis infection.

The Primary Lesion

A YOUNG adult, who had no infection in childhood, is tuberculin negative. When he acquires the primary infection, aside from the change to tuberculin positive, there are usually no symptoms or signs. In whatever part of the body that primary infection may be located, the tubercle bacillus elicits a similar inflammatory reaction. First the characteristic single tubercle is formed; around this other tubercles appear and an exudative reaction takes place in the surrounding tissues. When this primary lesion is in the lungs (as is most common in adults) then almost as soon as the tubercle is formed lymph drainage begins to the hilar nodes with enlargement and all other characteristics of tuberculous adenitis. The lymph may carry bacilli to the venous blood and right heart where it is carried back to the lung. The parenchymal primary lesion may grow or recede and following it the adenitis increases or recedes (Parrot's law).

This drainage into the lymph stream with adenitis is one of the characteristics of the primary lesion as contrasted with subsequent or secondary lesions. There are two other important characteristics: One, the primary infection only occasionally gives rise to slight transient fever or mild erythema nodosum but as a rule it gives rise to *no symptoms and no signs* whatsoever. Second, although it may persist for months it eventually proceeds to spontaneous healing or a state of complete quiescence. Healing cannot be hastened by any form of therapy and is not retarded even under unhygienic conditions.

It is important to know whether exceptions exist to the characteristic spontaneous healing or complete inactivation of the primary lesion. Present evidence is not final as to whether some primary lesions in adults give rise to clinical disease without an intervening period of complete inactivity. A definite answer to this problem can be given only when a number of young adults with negative tuberculin tests are re-tested until there is a positive reaction and then followed in later years for signs of clinical disease. As far as the evidence goes among white industrial employees in the United States, if there be any exceptions, they are rare. Among other peoples, either because of racial or environmental differences, presumably primary infections of adults instead of resolving, progress to clinical disease. Whether primary infection in children always resolves is not a problem for the industrial physician; here we are discussing only adults who did not have the primary infection in childhood. Long ago the innocuous course of most primary tuberculosis was inferred by pathologists from the finding of a healed primary lesion with healed adenitis in so many adults. These adults had no history of tuberculosis before the terminal illness which was entirely unrelated to tuberculosis. As nearly every adult is an example of recovery from primary tuberculosis, the primary infection must have an extremely low morbidity rate. A generation ago when no adult had escaped the primary infection, the tuberculosis incidence was less than 1%. This included all tuberculosis of infancy and all cases of secondary infection. Though we know the assumption is absurd, let us assume that the primary infection in adults gives rise to just as much clinical disease as in children. The chances of an untreated adult primary infection giving any clinical disease or symptoms at any time would be less than 1 to 100. I say "untreated" for, of course, no one thought of treating an adult primary infection in previous decades and it could not have been treated until, in recent years, the roentgen tuberculosis surveys have uncovered some of them in the active stages.

Many of these lesions are too small to be seen in the roentgen film. Some are visible only when calcium is deposited, that is, the active stage has passed. People whose primary lesion because of

size or location cannot be visualized, will never be incorrectly diagnosed as having clinical tuberculosis.

By strict definition the primary infection is limited to the site of first inoculation and its associated adenitis. Soon after the primary infection is seen lesions may appear in the upper lungs. These usually regress, but in a small number of cases they are known to develop into clinical disease. These are probably implants from the lesser circulation into which organisms had been carried by the lymph from the primary adenitis. The important fact for the case finder is that these post-primary lesions are intermediate in that, though they usually retrogress as would a primary lesion, they may occasionally produce disease as would a secondary lesion. Of course, some bacilli may pass through the lung to the general circulation or reach the general circulation more directly.

Although there are many who acquire that primary infection in young adult life whereas a generation ago all acquired it in childhood, this would present no diagnostic problem, for we would never see these primary infections if it were not for routine roentgen case-finding. It is our search for clinical (secondary) tuberculosis which reveals the primary lesion which was never seen in the active stage before the days of roentgen case-finding. If we had reconstructed in our minds the life history of the Ghon nodules and other residues of primary tuberculosis, then we would have been conscious of the fact that every Ghon nodule was once the site of an acute tuberculosis inflammation. Because we never saw the acute stage we disregarded the fossil and never pictured the living acute active process of which it is the visible remains. At the time when an individual, previously tuberculin negative, becomes tuberculin positive even without roentgen evidence of a lung lesion we may conclude that somewhere in the body there was a similar active tuberculous inflammation which in all probability will heal or become inactive.

This does not imply that secondary lesions of tuberculosis may not also heal spontaneously without symptoms. Secondary lesions giving large roentgen shadows are known to have disappeared within a short time and sometimes without leaving any scars. Though spontaneous healing is not exclusively characteristic of primary lesions, only the most exceptional adult primary lesions (if any at all) progress directly to produce symptoms, whereas we know full well how frequently secondary infections progress to serious disease.

The origin of all the secondary infections in adults has not been finally settled. A secondary lung lesion may develop by lymphatic or hematogenous or bronchial route or by extension by contiguity from a primary lesion. In such cases the lesions are due to the bacilli of the primary infection which occurred long before. Obviously, meningeal, kidney and bone tuberculosis are hematogenous. Adenitis is always endogenous either from lymph drainage of a focus or else it is hematogenous. Are *all* secondary lesions a sequel to primary infection (endogenous) or may some of them be the result of a new "exogenous" infection in a person who has been made allergic by a previous primary infection? If so, what is the proportion? This problem will not be discussed now; it suffices for our immediate purpose to recognize that the pathology of the secondary lesion whatever its origin, is different from the pathology of a primary lesion. The secondary lesion does not promptly drain into the lymph channels as does the primary. There may be no drainage or only a slight delayed drainage with a minimal adenitis. In primary infection, on the other hand, the adenitis is an accurate gauge of the extent of the parenchymal lesion. Calcium deposit, so common in the healing of the primary lesion and its associated adenitis, is less frequent in the secondary lesion. When healing occurs in secondary lesions it is predominantly by resolution and fibrosis. All this means that the reaction of the tissues of a person who has once had a tuberculous infection in the body is altered. Clinically, this altered tissue reaction is always associated with tuberculin sensitivity although experimentally the two can be dissociated. These secondary lesions are the ultimate objects of our search for they may progress for months prior to producing symptoms. We must discover them early. First, for the individual, because early treatment is the important factor in cure. Secondly, for the family and the community, in order to guard against the dissemination of tubercle bacilli. The early discovery of one secondary lesion is a genuine accomplishment.

In any roentgenographic case-finding among adults there will be films showing healed lesion of tuberculosis which are to be ignored. Some films will show active secondary tuberculosis for which we are searching, and still others will bring to view these primary transient lesions which now complicate the problem of case-finding.

All of the physician's acumen and all diagnostic aids have always been required to differentiate an active tuberculosis from an old inactive scar or a non-tuberculous lesion. Today in addition we must differentiate between (1) a primary lesion which is an active tuberculous pneumonitis but which will heal without any medical care, and (2) a secondary or early clinical tuberculosis which may progress to serious disease. If in addition to an active lesion a Ghon nodule is found or other evidence of old healed tuberculosis, such as hilar adenitis, we may conclude we are dealing with a secondary tuberculosis. The absence of signs of healed infection, however, can carry no weight because most primary tuberculosis leaves no demonstrable sign except the tuberculin allergy. Records of *past* tuberculin tests give valuable assistance in surveys of groups who have had these tests. In those who, for some years, were tuberculin positive the development of an active lesion is an indication for immediate therapy. In those who, a short time before were negative, we must observe the lesion over a long interval before taking any drastic action, because it is likely to be only the primary infection. When the tuberculin

test becomes positive we may be able to demonstrate the primary lesion in the lungs—or it may be in the intestines or in a tonsil, and, therefore, not demonstrable. It does not matter where it is, for the person with a demonstrable lesion in the lung is no more and no less sick, no more and no less potentially tuberculous, than the majority of people who become tuberculin positive by reason of a primary lesion not demonstrable on a roentgenogram. The infected adult will never know where he has the infection unless it is in a part of the lungs visualized by ordinary chest film. If a film is taken years after infection, the character of the shadow of healed primary lesion is easy to diagnose. But if he has a chest roentgenogram made a few months after the primary infection occurred, we are faced with one of the most difficult diagnostic problems. The physician sees a shadow of active pulmonary tuberculosis. There may even be tubercle bacilli in the sputum. When we discover such a case, we unfortunately rarely have had tuberculin tests for the year or two previous to guide us. How can the physician differentiate between a primary lesion with its transient activity and the asymptomatic secondary tuberculous lesions for which he is looking? This is the question that has made the diagnosis more difficult and more interesting than ever. It is in attempting to answer this question that we realize the necessity of combining periodic tuberculin tests with roentgen case-finding in adults.

The serious effect of the wrong answer is evident. For a healthy man or woman, who will continue healthy, unnecessarily to become an invalid for months or years, unnecessarily modify his mode of life and change or give up the work for which he was trained, and unnecessarily to suffer the fears of recurrence, is a catastrophe. The nurse or interne who is improperly classified as tuberculous has an additional unnecessary burden added to those carried by others. All hospitals are wary of accepting such individuals for employment, so that even though they go on to an uneventful recovery, they labor under the life-long disability of discrimination wherever they apply for a position. It is true that many authorities believe this primary infection represents a hazard; but if so it is a hazard for the remote future and not for the immediate present. Moreover, it is a hazard which is not diminished by stopping work, or by any kind of therapy. No doubt it is better never to have the primary infection, but the knowledge of when it is acquired is purely of epidemiologic interest and of no concern to the individual. The sanatorium or clinician treating such cases will apparently get wonderful therapeutic results, for the lesions invariably heal or become completely inactive. The only thing the sanatorium or clinician really does is to watch the normal evolution of a lesion whose nature is not and, perhaps, could not be recognized. Nothing in what has been said should discourage efforts to decrease the incidence of primary infection of adults. We shall, however, defeat these efforts if we do not at the same time recognize the significance for the individual, of the primary lesion.

Tuberculin tests prove what we may otherwise guess, that it is among the rural population that there are the largest number of adults who have never been infected. In estimating the probable number of positive reactors in any group aside from geographic origin, the social-economic status is important, for when there is less crowding in homes, even if in a city, the chance of primary infection in childhood is lessened. Race is a factor, for among negroes where the incidence of clincial tuberculosis is high, few will escape primary infection before adult life. When the younger members of non-infected groups go to colleges or into urban industry they will come into contact with tuberculosis. The industries which draw many employees from rural areas must expect that roentgen surveys will show some new or recent primary infections. In nurses' training schools fresh primary infections will be more frequent than anywhere else. First, because many of these girls come from rural areas and from the skilled worker and lower middle class, and, secondly, because the chance of acquiring the primary infection in a hospital is much greater than in other occupations. Unless these primary infections are differentiated, the industrial physician may jump to the unwarranted conclusion that there is an unusually high rate of clinical tuberculosis among the employees. In an industry without routine roentgen surveys these primary lesions will never be discovered and the tuberculosis incidence will be apparently lower. A hospital training school which has no systematic case-finding program will not be confronted with the difficult problem of differentiating between these primary lung lesions and secondary clinical tuberculosis. Where the case-finding method is used, those who have clinical (secondary) tuberculosis reap invaluable benefit because the lesions are discovered in the early stages when most amenable to therapy. Among all employees, but especially among nurses, who have so much more contact with children, the early discovery of the clinical secondary lesion prevents the further dissemination of the disease. For both reasons it is clearly the duty of the nurses' training schools to have efficient case-finding programs. It follows also that these schools must have expert individualized diagnostic service. Among all young adults the combination of periodic tuberculin testing and roentgen case-finding is desirable but among hospital personnel it is essential.

Summary

CASE-FINDING has become more complex because of the increasing finding of primary lesions in adults in the active stage. Case-finding requires individualized experts diagnosis. The physician must know more than roentgenography; he must know tuberculosis pathogenesis and prognosis. The problems of diagnosis can, in part, be solved by combining periodic tuberculin testing with roentgen case-finding. Data needed to fill gaps in our knowlege of tuberculosis can come from the periodic examination of groups, and the physicians

in industry, in colleges, and especially in nurses' training schools, have a unique opportunity to contribute in this way to medical progress.

Clinical Suggestions on Intestinal Obstruction

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OBSTRUCTION of the bowel is a large subject and I shall talk mainly about the mechanical obstruction. Much that I may have to say probably will be more or less trite, but the subject is very old and the mortality rate is still high, so we feel that possibly a little review from time to time may help us to handle this difficult problem of mechanical obstruction of the bowel.

The diagnosis in general is usually easy. The symptoms are cramp-like abdominal pain, vomiting, tympanites and obstipation. Vomiting is more or less persistent, depending upon the point of obstruction; the higher the obstruction the more severe and constant the vomiting. On the other hand, tympanites is marked from the beginning in large bowel while in high bowel obstruction it is very slight. Obstipation or inability to move the bowel is somewhat of a relative term because some of these people do move the bowel after onset but, of course, sooner or later, there is a definite indication that the bowel will refuse to move. So it is easy to make a diagnosis of a mechanical ileus. If we wish to corroborate our findings, auscultation of the abdomen will give pronounced peristaltic sounds, more marked in one part than in another, indicating that the site of obstruction is probably in that area.

Outside of that, the thing that I wish to call your attention to in the location of the obstruction in mechanical ileus is the use of the x-ray. We cannot always use it in some of the very acutely ill people with very high obstruction, but I would say that in 90% of the cases an x-ray film can be taken and I should like to show you one or two.

Here is a case of acute intestinal obstruction. The patient is in the upright position. This is probably subacute as the patient was having definite evidence of obstruction for some time. I would call your attention to the little mirror lake formations you see on the right side of the film and one on the left, indicating, of course, that there is a fluid level produced by gas and fluid in the small bowel. That is entirely abnormal. Gas, as a rule, is not present in the small bowel and its presence indicates obstruction.

The next slide shows a stepladder-like pattern on the film, indicating a marked distention of gas in the loops of the small bowel, extending across the abdomen. This was taken with the patient lying flat on the table.

The next is a film of the large bowel which you can see is quite distended due to obstruction low down in the region of the sigmoid.

The last slide is a film of an obstruction which occurred following carcinoma of the uterus which I could not remove completely. Two years later this woman had evidence of intestinal obstruction. She has gas in the large and small bowel with distention in both. At operation I found that she had an attachment of the ileum and sigmoid to this carcinomatous area.

NOW there is the question of the cause of mechanical ileus. Strangulated external herniae form about 50% of the cases. Therefore, the first thing we should do is to examine the hernial rings. Sometimes the hernia is very small as only a small loop of bowel gets caught; that is especially true in the femoral region. In addition to the ordinary hernia rings, incisional hernia is to be thought of, especially if the scar shows that drainage was used. Those patients are prone to a hernia formation which may become strangulated.

Then we should consider the age of the patient. In children, especially the newborn, we think of congenital atresia of the bowel. At a little later age the passage of blood and mucus in a child from six months to two years of age would indicate intussusception and usually this can be palpated. In older patients, especially if there is tympanites, we think of carcinoma of the big bowel which occurs so frequently at that age. In some cases the tumor can be felt very readily by rectal examination.

In addition to that we think of volvulus which may occur in both old and young people and produce tremendous tympanites. These are the possible conditions we think of and they will probably account for 75% of the cases. For the remainder, of course, mesenteric thrombosis, internal strangulation, etc., will probably be discovered only at the time the abdomen is opened. Drainage scars should be suspected not only for strangulated hernia but also because bands of adhesions in the abdomen may be the cause of intestinal obstruction and should be given great consideration.

Having made a diagnosis so far as we can, it is always wise to see that these patients during examination are given sufficient fluid to replace that which is lost by vomiting. These patients respond very much better if properly prepared, so we use normal salt solution. This given intravenously together with 5% glucose solution will brace the patient up a good deal. In addition, as you never know just what is going to happen, it is always wise to have a blood donor available; you may not need him but if you do it is a great relief to have him. The stomach should definitely receive attention; its contents should be evacuated and a Levine tube left in place during operation for you must see to it that the stomach is constantly empty. Many operations would be more successful if the patient did not die from aspiration pneumonia soon after operation. Some of these people at the beginning are taken sick so suddenly that they are in shock and naturally that demands immediate treatment. The application of external heat and

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the use of fluids as spoken of will usually pull them out of shock. Morphine, which is a valuable thing in the treatment of shock, should definitely be withheld in all such cases until you are sure the patient realizes his serious condition and consents to operation.

When we think of the operation we should start with the anesthesia. Many people prefer spinal for these patients; I am frank to say my experience is limited and I am cautious, especially in elderly people, since it may cause a marked fall in blood pressure which may be fatal. I think it should be given only by those who have had large experience in its use. It is nice for a surgeon as the abdomen is soft and the bowel is relaxed. We have used ethylene together with local anesthesia and found it satisfactory. I know Dr. Metz uses morphine and scopolamine and has found it satisfactory. I do not think local alone is satisfactory, and I am sure it is harder on the patient.

The location of the incision is guided by your diagnosis as to the probable site of the obstruction. Usually it is paramedian to the right or left of the midline above or below the umbilicus. The incision is made not too large in the beginning because it is always wise not to eviscerate these people. Usually the first loop that comes up when the abdomen is opened is a large, distended loop and if you follow that down you find it gets larger as it approaches the obstruction. By following it down with your hand you can often land, within a few moments, at the site of obstruction. Otherwise start at the ileocecal valve, as that gives you an idea whether the obstruction is above or below that point. There should be no question but that every operation for intestinal obstruction be entered into on a very open minded basis. You must not decide beforehand what you are going to do. You must be prepared to do whatever seems best at that particular time. A hernia that can be reduced and the strangulation relieved is all right, but many cases are lost because the hernia is reduced and nobody looked at the bowel. I think it is always a good idea to see that the bowel is viable. If you do a resection I am sure you will want to go out into healthy bowel so there may be a good blood supply. Many cases unfortunately are in such a condition that you cannot feel around in the abdomen or the patient will die. In those cases it is wise to put in a fair sized catheter and drain the bowel, being careful not to let any of the material leak out. You can evacuate the gas, put in a catheter, suture it to the abdomen wall and it will drain just as well as a tube. Many times the patient will recover if you give him a chance to get over the acute stage and then you can go back and relieve the obstruction.

As to the postoperative care, there is nothing new to add. Morphine and continuation of the Levine tube are wise. Let me warn you that if you use the Wangensteen method of drainage you should interrupt the suction for five or 10 minutes every hour. We have lost two cases from gastric hemorrhage because of not interrupting the Wangensteen treatment. Glucose and salt and blood are also used as needed.

Traumatic Surgery

—*Some Principles of Treatment*—

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WITH a hundred thousand accidental deaths in the United States each year and more than a million injured it would be hard to over-estimate the importance of traumatic surgery. The World War gave great impetus to traumatic and plastic surgery. With it over, the graduate in medicine and intern hesitated to make special preparation for this field of practice. But the reckless speed of the machine age in which we live soon made a piker of a mere war. Traumatic surgery is now quite uniformly distributed, is most constant in supply and bids fair to be the very last to fold its tent and march away from the Queen of Arts, surgery. Dr. Rudolph Matas, of New Orleans, the Dean of the Medical World, recently stated that, "Surgery is at its peak today, but with the advance of medical science it will decline steadily until is serves only to patch up the results of accidents." Just how long accidents and civil combat will feed the profession with traumatic surgery we do not know. We are in dead earnest about preventive medicine, but preventive surgery we have not taken so seriously as a profession, it seems. The railroads are to be complimented for making the greatest advancement in the reduction of accidents. They simply haul millions of people millions of miles without the loss of a life. Many factors are responsible for their fine record in human conservation no doubt, but in our opinion their greatest prophylactic measure against accidents has been their rule for many years of not allowing their engineers and other employees to come on duty while intoxicated. In this way the railroads have been the leaders in preventive surgery in the traumatic field. Prevention is a major consideration in every field of practice.

Prevention in traumatic surgery constitutes a great challenge to the medical profession, to the business and industrial world, and to the nation as a whole. The consumption of whiskey as a beverage is incompatible with the machine age in which we live. In a very recent report by a committee of the American Medical Association to study problems of motor vehicle accidents, it concluded that a person driving a car with 0.15% alcohol in his blood was 55 times more likely to have an accident than the one who has no alcohol. Five-hundredths concentration is considered sufficient for prosecution by this committee, and even a less amount may be dangerous for a driver. Anesthetics for minor surgery, insulin, opiates and barbiturates play a part in motor vehicle accidents, as well as mental deficiency and poor eyesight. So we insist that the first consideration in the treatment of cases of traumatic surgery is pre-

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vention, and there is much the medical profession can do about it.

Careful study in the prevention and the treatment of traumatic surgery is of growing importance, especially in the South because of the development of industry, the increase of motor vehicles, automobiles, trucks, tractors, and multiplied forms of machinery on the earth and airplanes above it. There is not a practitioner in the country but who may be called upon to meet any and every type of traumatic surgery any day in the year. Whether he does the major surgery himself or not, first aid must be administered and transportation directed which is of the greatest importance. No doctor can shun his responsibility in traumatic surgery.

THE very first consideration of the problem before us next to informing our clientele on the principles and measures of prevention in this field of surgery is to remind ourselves of the importance of preparedness. Every practitioner, regardless of how small his town should have his amamamentarium ready for first aid and other life-saving measures. Every local surgeon as well as every general practitioner should have a trained nurse in his office to help him. A thrilling instance of the importance of preparedness was recorded in March, 1905, when the train wrecked near the little town of Homestead, Iowa, a rail having been removed for the purpose of robbery. The little village had only about 300 population, the wreck was a mile and one-half out and on a fill 54 feet high at 12:30 in the night, but Dr. William Moershel met the situation in fine order, his division surgeon having remarked later that he was so surprised at a local surgeon being so well prepared to care for an emergency with everything that was needed. Another lesson, however, to be learned from the account of this remarkable wreck was that the engineer complained of only a very slight scald, but died later of infection. The moral of this death is that no one case of traumatic surgery should be considered of little importance.

The very first consideration must be given the injured patient at the site of injury. Profuse hemorrhage is a first consideration. Pressure on the wound with the cleanest material possible should be understood by the doctor and taught to the laity. Sugar or salt poured into the wound might not do serious injury, but soot from the chimney is too bad. Every surgeon in a small town knows that this procedure is common. In our section, August and September are stovewood months and we have many wounds of the hand and some of the feet of the stovewood splitter. For the last two years through the editorial columns of our weekly paper we have advised against this soot procedure and insisted on pressure directly on the wound with a clean white cloth, and the results have been most gratifying. We believe that the grace and dignity or the classical way of splitting stove wood in the South by holding the bolt in one hand on a block and hacking off the sticks with the other without the bending of the back nor exertion to point of perspiration, must be abandoned for one that will secure more safety.

Dangerous hemorrhage is the first consideration in an injured case. It having been controlled, shock is the next consideration. It may be so severe that the patient should not be removed for a while from the place of injury. Pain, the loss of blood, and the collapse of the veins are factors to be combated in shock. Morphine, adrenalin in oil or ephedrine sulphate, can often be used to good advantage even before the patient is moved. Injury to muscles, blood vessels and nerves may be very serious if fractured limbs are unsplinted before being transported. Brookes, of the Department of Surgery of Washington University at St. Louis, stated two years ago that of a series of 90 cases of fracture-dislocation of the cervical spine, 10 had been transported five to 300 miles, and that it was the exception to find that any effort had been made at adequate immobilization. Fractures of thoracic and lumbar spine are more safely transported on the abdomen it seems, but those of the cervical region on the back and with head and neck fully extended. Humphries, in the gold mines of South Africa, transports his patients in the position in which they are found as a rule. It is important to combat shock before major surgery is considered and often times before thorough cleansing of the wounds.

Antiseptics for the skin and for wounds are many and each has its advocates. Iodine is still a favorite with a large number. It is a very effective antiseptic no doubt, so far as the destruction of bacteria is concerned, but we do not give it space in our office; it is too severe on the tissues, and unless the wound is anesthetized well before its application it may cause shock from pain. Mercurochrome, merthiolate, bichloride, picric acid and metaphen are widely used. We do not believe in caustic antiseptics for wounds; we do not believe in treating trauma with more trauma, and adding pain to more pain. Benzene, ether and carbon tetrachloride are good solvents for grease and oil that must be removed in many cases. The wounds should first be anesthetized with 1% novocaine with adrenalin. The adrenalin helps to control the hemorrhage and prolongs the anesthetic. Butyn applied locally may be used to advantage in some cases. Gauze dipped in warm saline packed in the wound and vaseline applied on top to keep out water and green soap is a good precaution while cleaning the skin around the laceration. The careful removal of foreign material from the wound and the cutting away of tissue that can not recover is of the greatest importance.

In addition to antiseptics for combating wound infection Hart, of Duke University, is using ultraviolet ray to destroy the bacteria in the operative field. He feels sure that the radiation does not hinder the healing of the wound.

Blood transfusion is used to combat shock and to aid in combating infection in delayed healing. It is time for the country surgeon to have at his disposal professional donors who may be available on short notice, and to have a laboratory techni-

cian who can test one blood against the other to make transfusion safe. The blood bank may be on its way to our rescue. The first living donor blood bank was established at Cook County Hospital, Chicago, in May, 1937, and in October, 1938, 4,400 transfusions had been given, 333 monthly, at a cost of one dollar per transfusion. In an emergency the transfusion may be begun within 45 minutes after the admission. Cadaver blood has been used for some time, and now placental blood is being utilized by Dr. Sammartin, in Buenos Aires. It looks as though the country practitioner may soon be able to carry blood with him right out to the place of accident or to the home and give it with safety and at a most reasonable cost. It seems that stored blood has been used in Spain on an extensive scale since 1937. It can be used as long as 15 days after collection by keeping it on ice and adding Ringer-Locke solution, according to report.

AS IN acute appendicitis or other adominal emergencies time is a most important element in fractures. The clotting of blood, swelling, and muscle spasm make perfect reduction most difficult after 48 hours according to Hein, of Toledo, in checking 228 major displaced fractures. In his series no perfect reductions were obtained after 48 hours. In the war in Spain it seems to have been the custom to carefully cut away the macerated tissue, then put on the cast and let the fracture be for a longer time than has been customary heretofore, even though the pus pours out and the odor is bad. Polyvalent serum is used to combat gangrene, as is x-ray to advantage. Sulfanilamide, the panacea for all ills, is being used by many to combat infection in traumatic wounds.

The prevention of tetanus must be considered in the early hours of injury . If tetanus antitoxin is indicated, the earlier it is administered the better. If the patient is in extreme shock some time should be given and if he has had serum before, it is to be administered with caution. Fifteen hundred units of antitoxin is the average prophylactic dose if given within the first few hours. According to Cohn, of New Orleans, the routine use of prophylactic serum is not justifiable. The disease is one of soil contamination and wounds received in barnyard, rich soil, Fourth of July wounds and gunshot wounds should receive the serum. He declares that the indication should be based on reason and not just because a wound exists. Carbolic acid or other severe caustics should not be used because of dead tissue away from the air activates the growth of the bacteria. If the wound involves the intestinal tract or is near the rectum, diet is important. No raw or uncooked vegetable or berries should be given. Dr. Matas, of New Orleans, follows an antitetanic dietary regime for three days before operation on rectal or perineal cases. When there has been no time for preparation he often gives a prophylactic dose of antitetanic serum. Often times the most minor wound apparently is the most serious as far as tetanus is concerned. We are reminded of one fatal case caused by the puncture wound in the foot of a woman by a four penny nail out at the hen house. Tetanus antitoxin in the spinal canal is not advised, neither is massive doses after the onset. If 30 to 40 thousand units does not relieve the patient no amount will likely do so after the disease is fully developed. Symptomatic treatment may be of much benefit, as a quiet dark room, fresh air, amytal, and proper nourishment. Another very important item in handling open wounds of traumatic nature is to be sure of proper sterilization of thread, instruments and especially the gauze for dressings. Sterilization should be thorough. It should be done by one who knows the sterilizer and knows how to handle dressings safely.

THE foregoing are a few of the fundamental principles to be considered in traumatic surgery. Many cases of major injuries will need to be referred to the base hospitals so to speak, to the more experienced surgeons, but multiplied thousands of minor injuries can be handled by the general surgeon in his own office or the near by community hospital. We want to make an urgent plea for more consideration in the treatment of minor injuries. The general practitioner must be enlisted and the laity informed if we are to reduce the number of injuries now occurring. No injury should be considered of minor importance as stated above. The mere prick of the sharp corner of a plow on the knee of a ten year old boy caused a blood stream infection and also tetanus on the eleventh day and death followed.

Chronic trauma must be considered in general practice. The callus on the foot caused by an ill fitting shoe calls for thousands of operations each year and lowers mental fitness in multiplied hundreds. The fitting of shoes should be a part of the work of the general practitioner and a course in this art should be added to our medical schools.

PERINEAL lacerations constitute a large field in traumatic surgery. The proper repair of these and tears of the cervix challenge the rank and file of our profession. Abstaining from the administration of pitruitin would no doubt prevent many of these wounds. By the aid of a nurse,a local anesthetic and a kit of a few well selected instruments, the practitioner can repair each when it happens, as it should be. This routine would add much comfort to many patients and no doubt prevent cancer in many instances.

We would like to insist on the more careful handling of the every-day minor wounds that come to us all the time, in the interest of ourselves and especially for the benefit of the people we serve. After all the majority of people do not appreciate their scars, and they are not good advertisement for the profession even if they are small. The old adage, "Take care of the pennies and the dollars will take care of themselves," might remind us to take care of the minor surgery, each and every traumatic wound, and the

people will come to us with many which they have heretofore treated themselves at home. People do not like to be hurt, and it is not often necessary. A little novocaine can be injected around the site of the wound with a very fine needle without much pain, and even a small child may be spared while the small wound is being cleansed and sutured or dressed. It is very important to shave the hair from around a wound as well as to remove all foreign particles from within.

The clipping of a tendon often occurs from a very small cut, but the bringing of the ends together with the greatest care and the utmost pains in suturing the ends with a two to four (O) platted silk is of major importance. The sooner this is done after the injury the better. The severing of a nerve is of quite as much importance and time should not be spared to find the ends, trim off the traumatized part, and approximate with the utmost care with a number six silk. While all minor wounds are important, those of the face should summon our most painstaking efforts.

Green soap around the wound and warm normal saline in it are all that are usually required as cleansing agents or antiseptics. The macerated tissue should be removed conservatively and with the utmost care, removing enough to prevent suppuration and not enough to leave a depression after healing. Muscle and fascia should be brought together so as to build up under the skin. Fine cat-gut is best used for approximation of muscle and care must be taken not to cut the muscle by too much pull. Nature abhors a vacuum and surgery a dead space; this is especially true in wounds of the face. Avoid drainage of minor wounds of the face if at all possible.

Extreme care in tieing the very smallest bleeders, is an important aid against drainage. See that the edges of the skin are smooth and bring them together snugly. Very light pressure may be applied to the dressings rather than drain, but the idea of course is to put the tissue back where it was and not have to use sutures nor pressure. Let the dressings remain for a few days without removing unless there is an indication that something is wrong. After the third or fourth day it is well to keep a close watch on the stitches to see that no one cuts in and leaves a scar. Elastic bandage is used to advantage often times to relieve tension on the stitches. Wounds about the mouth and nose often do better without any dressing. The wounds of the face especially should be watched for several weeks. If there is a tendency to keloid healing x-ray or radium should be used, radium for the small wounds, x-ray for the larger ones. We should give special care to the very least wound on the face for the sake of beauty and symmetry as well as function and on behalf of the right mental attitude of the patient. An ugly scar might cause an inferiority complex that would do great damage to the patient as well as hindering him or her in securing a good position. It has another important value in the protection of the insurance companies against damage suits as well as the doctor. Expert care of the minor injuries of the face makes grateful patients and forms a good security against state interferenece with the relation of patient and doctor.

SUMMARY: Traumatic surgery is of more universal interest to the profession than it has ever been. A large percent of it may be prevented if the medical profession should become sufficiently aroused and the lay public properly informed. Transitory deficiencies are responsible for a large part of the motor vehicle accidents, alcohol being the major offender. Traumatic surgery demands prompt attention and often times heroic efforts to conserve human life and restore the function of the injured organs or parts. The most painstaking efforts are due to care of even minor traumatic wounds and skill expended on the very least of a minor case will pay and will be appreciated by the patient, especially those of the face. Let us perform a major service to the people by doing our full duty to minor injuries — and a still greater service by prevention one half of all.

Compound Fractures

—*Management and Treatment*—

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THE treatment of compound fractures has undergone a radical change in the past decade, and although there are still divergent views and opinions as to matters of detail and management, it is now generally conceded that the immediate operative care of these cases is the surest way to a satisfying outcome.

In the earlier years, the teaching was that the *wound* should be cared for, the *fracture* let alone until all chances of infection had cleared up, or the infection itself controlled. Such management and treatment, as we all know, resulted in the loss of many limbs, often death; and among the patients that recovered numerous cases of mal-union that necessitated difficult corrective operations, with the ever present danger of lighting up a hidden focus of infection. Twenty years ago I began to question this method of treating only the wounds of the soft tissues, and letting the fracture itself wait on a possible infection; too often I had seen these cases going on to firm bony union of the fractured fragments, in bad position, overlapping, with concomitant shortening, even in a bed of pus. I became convinced that time would be saved, infection prevented or stopped, and limbs preserved, if a more radical treatment were instituted. By repeated tests I proved to my own satisfaction the correctness of my theory and from then on all of our compound fractures were

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operated on immediately. In 1927 I reported before the S. C. Medical Association my success with this — considered at that time — *drastic* management of compound fractures, and advocated general acceptance and practice of the immediate operative treatment. My suggestion met with severe criticism even at that late date. Time and the work of many others have proven the *now* little questioned superiority of this "bold" treatment.

Too much emphasis can not be laid on the fact that compound fractures are severe crippling surgical emergencies, and that potentially all these injuries are infected from the moment of their occurrence and should be so regarded. Undoubtedly the best method of combating this infection, as well as repairing the limb, is by immediate operation; the final result bears a very definite and constant ratio to the time elapsing between the injury and its operative management. We should impress this necessity for prompt action upon all those likely to be called to give first attention to such injuries.

Foremen of railroad shops and other departments, heads in mills and general industrial plants, officers of the Police department, Fire department, and Motor Patrolmen—because so many of these injuries result from automobile accidents and high speed industrialism—should be taught to splint these cases before moving them, using any splint available, a rolled blanket splint or even boards to prevent further injury and shock, while the patient is being transported to a hospital. They should be taught above all things *not* to pull the limb to replace the protruding bone ends, but to cover the wound with any available clean cloth. Hospital authorities, resident physicians, interns, and nurses in charge of receiving wards should be cautioned constantly that compound fractures are emergency injuries and *must* be attended to at once. Surgeons on duty, be they general or orthopedic surgeons, depending upon the hospital staff set up, must realize that these cases cannot be neglected a minute regardless of conflicting operations or other engagements, because the time element *is* one of such vital importance.

I OFFER for comparison of results, a case handled by immediate operation and one of delayed attention: A man working on the highway, was struck by a trailer that broke loose from an auto. He sustained a compound, comminuted fracture of the left tibia, and a multiple comminuted fracture of the left fibula. A large area of the skin on the mesial and posterior surfaces of the leg was torn away, and his left forearm showed a comminuted fracture of both bones. He was rushed to the hospital and within one hour was on the operating table for a debridement and fixation of the fractured leg. Leaves, much dirt and even small pieces of rock were removed from the wound. For several days following the operation a rise in temperature occurred. At the end of one week the forearm was operated on, with no rise in temperature. In eight days the temperature became normal and remained so thereafter. He was dismissed from the hospital on the twentieth day.

On the other hand: A young man of refinement, clean of habits, was injured in an auto accident, sustaining a compound, comminuted fracture of the leg and a fractured arm. He was given first aid attention at home, and many hours later was sent to the hospital; when seen the foot was swollen, cold and painful, the dressings soaked with blood, the boy in severe shock. After an intravenous of glucose he was operated on, a frank debridement being done, the bones fixed in apposition, the wound, where it was not feasible to suture, packed with vaseline gauze, then dressed and a plaster case applied. In a few days a virulent infection set in, and an amputation was done to save his life. What the outcome might have been, if immediate surgery had been done we can only surmise.

COMPOUND fractures cannot be standardized as to treatment; general rules can be made but as no two injuries are exactly alike, the handling of no two will follow the same identical plan. While plates are clearly indicated for some, others will require skeletal traction with pins; still others must have the fragments wedged together and held in position by pins above and below the site of the fracture, the pins being fixed in the plaster casing. In the end the attending surgeon must decide, from experience, the particular surgical need of the individual case.

The shock present, except when extreme, is best combated by immediate surgery; restorative measures can be carried on at the same time and valuable time saved. In extreme shock, we must postpone operative measures for a variable period of time until the patient's condition improves; that can be hastened by intravenous glucose and saline, by external heat, morphine, or, if a large amount of blood has been lost by a transfusion.

Preliminary x-ray examination is advisable if readily available, because much valuable information can be obtained before operating and frequently a pre-operative decision made as to the surgical procedure. The examination can be done while waiting for the setting up of the operating room, but no attempt should be made to remove the clothing, or first aid dressing. Make the examination as the patient is at the time.

The operative procedure, must be one of thorough cleansing, debridement, fixation, and immobilization. My usual technique is as follows: Under a general anesthetic, preferably gas-oxygen and ether—the temporary dressing are removed, the wound covered by a sterile pad to prevent further contamination; the skin is shaven, scrubbed thoroughly with tincture of green soap and sterile water, then washed off with sterile water, followed by ether and alcohol. The wound itself is then scrubbed with soap and water, the bone ends if protruding are carefully washed, the wound irrigated with quarts and quarts of saline solution and finally the limb is mopped with a sterile

towel, and painted with tincture of merthiolate. Following this preparation, the limb is draped and the actual operative measures commenced. (All of the preparatory treatment should of course be done with gloved hands.)

Begining the debridement, a thin portion of skin is excised from the wound edges together with the underlying fat and soft tissues; the knife and forceps used for this are discarded, and with a clean knife all traumatized and devitalized muscle tissue is excised. Then if it is deemed necessary the wound is enlarged, using still another clean knife, the edges of the wound and any incision made are blocked off with sterile towels, and the opening is gently retracted, so that all small and unattached piece of bone can be removed with forceps. The major bone fragments are then cleaned up, and when particles of foreign matter are found embedded in the bone ends, they are removed by curette or rongeur; after which, the wound is again thoroughly irrigated with saline solution, to wash out all crevices and pockets. When that is finished the wound is carefully packed with sterile gauze to control oozing while the fracture itself is receiving attention. Rarely is there much difficulty in approximating the fragments, certainly no force or roughness is needed. When the fragments are approximated, they are held in position either with a Lambotte clamp or with bone holding forceps, until they are firmly fixed, by a plate, screws or pins. The packing is then removed, and the wound closed with interrupted sutures, without tension and without drainage. If the wound cannot be closed in its entirety because of loss of skin, we endeavor to close it over the site of fracture, but do not undermine the soft tissues to accomplish that end. I do not believe undermining of the soft tissues is ever in order. Lastly, a vaseline gauze dressing is applied and finally a plaster case. During the above operative procedure a 15% glucose solution is given slowly intra-venously, and before the patient leaves the operating room, anti-tetanic serum and gas-bacillus vaccine are given.

There is a decided difference in opinions as to the use of non-absorbable fixation material, such as Sherman or Lane plates, screws, wire, pins, etc., in these cases. I have for years applied such material in the internal fixation of fractures with no bad effects on the final results. Even in cases with an actual loss of bone, we have bridged the gap with a Sherman plate and had the fracture go on to solid bony union, and a weight bearing, functional limb without any shortening.

Where Sherman or Lane plates *are* used for these internal fixations, the plates should be removed when an x-ray examination reveals absorption of bone around the screws. It is my rule of practice to *always* remove a plate from the tibia, because of the thinness of the soft tissue covering, to prevent possible future trouble and disability from an ulcer, or, from the breaking down of the soft tissues as a result of some trivial traumatism.

Orr has advocated, in cases where an actual loss of bone has taken place, a sliding bone graft to bridge the gap and reports good results. I have not tried it, and I am not convinced of the advisability of such a procedure. A sliding bone graft might open up a wide field for an osteo-myelitis to develop in those cases where infection occurs in spite of an early debridement. If a bone graft *is* to be used then a tibial onlay graft from the uninjured leg would, it seems to me, be a better and safer procedure. A bone graft taken from above or below the wound, leaves an inviting channel for the spread of possible infection. A graft from the other leg adds of course another wound and another area of pain. Repair by sliding bone graft means a larger and more susceptible injured area at one operation. Repair by plate, may mean a second operation but in my opinion, it lessens the threat of serious trouble in the first.

In all cases whether internally splinted or not, absolute immobilization of the part is the paramount factor in postoperative healing, and I believe that is best achieved by the plaster case. Post operative dressings of these wounds should be few and far between; each dressing adds one more danger of secondary infection. I am a firm advocate of the Orr method of handling thesee cases without drainage and with few postoperative dressings.

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Separation of the Acromio-Clavicular Joint

—Management and Treatment—

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INJURIES to the acromio-clavicular joint are common, and they occasion considerable disability. Owing to the fact that the joint is superficial, a diagnosis by inspection and palpation can usually be made at once. If the separation is well marked no time should be lost in useless manipulation and unsatisfactory splinting. I will admit there are a few marked minor subluxations which may admit of this conservative form of treatment. It interested me to find that these dislocations of the outer end of the clavicle were not infrequently accompanied by tearing fractures of either the outer end of the clavicle or the acromial process of the scapula. They were, therefore, fracture dislocations. In reviewing the treatment of these injuries, I was surprised to find that many men recommended suturing of the capsular ligaments or the conoid and trapezoid ligaments. If it were merely a matter of restoring

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these ligaments, I am of the opinion that they would restore themselves by normal healing if the bones were to be held in proper position for a reasonable time. They are fibrous tissue which has a great tendency to regenerate. Suturing does not encourage regeneration. When the firm union between the outer end of the clavicle and scapula has been disrupted it is extremely difficult to hold the bones in a position which will admit of satisfactory regeneration of the ligaments. They usually unite with some increase in length due to the stretching force of the arm's weight. The firm attachment of the clavicle to the scapula is difficult of restoration when once it has been destroyed. I have a feeling that if this acromio-clavicular articulation could be made strong there would be enough regeneration of fibrous tissue at the site of the joint and in the region of the conoid and trapezoid ligaments to produce a stable shoulder girdle.

Many schemes of management have been tried for separation of the acromio-clavicular joint. They vary from a simple sling bandage, which is passed under the elbow and over the shoulder, to very complicated operations in which the bones are fixed by wire, fascia or other suture material. The operation which I have used on a number of patients consists of an incision made over the outer end of the clavicle which will permit exposure of the contact surfaces of the acromio-clavicular joint. The bones are then beveled in a manner that will permit the clavicle to insinuate itself beneath the process of the scapula. Iron wire of a fairly small gauge is used to hold the bony surfaces in opposition until a firm fibrous union occurs. This usually takes about five or six weeks, after which time the wires may be removed. If care is taken to mark the site of their insertion they can usually be quickly removed under local anesthesia. The arm is kept at right angles to the body in an aeroplane splint during the first two or three weeks after which it may be held by a simple sling. Very little permanent disability results in these cases and a very stable union is usually secured.

Discussion

DR. EDWIN W. RYERSON, Chicago: As I see more and more of these cases, I see a great many who make an excellent recovery without any operation; but, as DR. MCNEALY said, in a case where there is wide displacement and where the conoid and trapezoid ligaments are torn, something should be done. As time goes on I believe we will favor reinforcing the conoid and trapezoid ligaments by a facial loop passing around the hook of the coracoid and around the clavicle, and I believe that this is structurally and essentially a little more mechanically correct than simply wiring or simply sewing together the joint itsef, because the stability of the acromio-clavicular joint is not due so much to the capsule and ligaments of the joint as it is to the strength of the conoid and trapezoid ligaments.

I am glad DR. MCNEALY mentioned the method of locating the wires. I tried his operation and the young man complained of so much pain which he thought was due to the wire sutures that I spent at least an hour hunting for those two wires that were so covered with fibrous tissue that I wished I had never put them in.

DR. GEORGE L. APFELBACH, Chicago: There is one point that one must take into consideration on these acromio-clavicular joints and that it the functional result. The acromio-clavicular joint has a definite function in the rotating scapula and its main function is the thrust function. If we wire that joint, you naturally lose the function of the acromio-clavicular articulation. You can maintain the clavicle and acromial process in position without much attention to this joint by utilizing the conoid process and bringing the clavicle down at the time of operation and use braided silk and bring it under the corocoid process. We prefer to use braided silk and to bring the clavicle down and allow the conoid and coracoid to heal. I do not think suture is necessary, but by bringing the clavicular joint down and holding it in position, you can thus clean up the joint and suture the ligaments so that you won't interfere with the future function. I think that this is of added value in consideration of operation on the acromio-clavicular joint.

DR. WILLIAM R. CUBBINS, Chicago: I was very much interested in reading this man's paper from Minneapolis in which he states here is a rupture of the transverse portion of the conoid and trapezoid ligaments. We had three or four cases in which we found these two ligaments were torn from the under surface of the clavicle, and by the time we had a couple more, I was very sure it had pulled off the coracoid; so we made a nice hot diagnosis of just how this occurred, and we found that the two ligaments had ruptured right in the middle without any question whatever. One or two had been torn off the coracoid and one or two had been torn from the clavicle.

One factor has annoyed me, and that is the strength of the silk that is used. We use two sizes, and use two anterior and two posterior that hook around the coracoid and hold it down, but there is an excess amount of motion in that joint and they have not been as satisfactory as I would wish.

There is one thing against the conservative treatment. So many times these are pulled right out of the capsule, which will leave the capsule remaining with one end pulled out and there is no contact. It will never grow together, and that is another factor in the dislocation of the anterior end of the clavicle.

I think the beveling DR. MCNEALY demonstrated is well worthy of consideration, and I doubt if it would interfere with that thrust which DR. APFELBACH mentioned.

DR. ARTHUR H. CONLEY, Chicago: In DR. MCNEALY'S words this seems a relatively simple affair; but one of my experiences in operating acromio-clavicular joints has been that, if it is not operated early, it is found that when we attempt to bore a couple of holes, the clavicle is so soft that it will not hold the wire and the wire will pull out. The procedure of choice, so far as I am concerned, is binding it down with the coracoid process.

DR. RAYMOND W. MCNEALY, (closing): I should like to emphasize two points which I made in my paper which for the sake of clarity may bear repetition.

The first has to do with the growth of fibrous tissue. The capsular ligament and the conoid and trapezoid ligaments tend to regenerate quite promptly. If the position of the bones were satisfactory one would have little disability. When there is instability in the joint these ligaments tend to stretch out and it is this condition which gives rise to the deformity and impairment of the function.

The second point is the one made by DR. APFELBACH who suggests that a firm bony union between the acromial process of the scapula and that of the clavical might limit the degree of satisfactory mobility which normally exists. It is my impression that when one bevels the two opposing surfaces and removes some of the cartilage from their surfaces enough fibrous union develops to preserve their proper relations. I believe it would be very difficult to get firm bony union at this site, and we need not fear this too firm union.

Central States Society

—Proceedings of the Joint Meeting of the Central States and St. Louis Medical Societies, St. Louis, February 9, 1940—

C. O. Sappington, M.D., Dr.P.H.,
Chicago

A COMBINED meeting of the Central States Society of Industrial Medicine and Surgery and the St. Louis Medical Society, on industrial medicine and surgery was held at the Hotel Statler, St. Louis, Missouri, Friday, February 9, 1940. The Program Committee consisted of Dr. E. C. Holmblad, Chairman, and Drs. Leo A. Will, E. C. Funch, and Theo. Hanser.

The subjects presented, as the program will show, are of great importance to the industrial physician and surgeon. There was excellent attendance and discussion was well rounded. The program and abstracts of papers presented follow:

MORNING SESSION: "Occupational Dermatitis," Dr. Garold V. Stryker, Department of Dermatology, St. Louis University School of Medicine.

"Differential Diagnosis of Back Conditions and Pain:

(a) "Urological Viewpoint," Dr. C. E. Burford, Professor of Urology, St. Louis University School of Medicine.

(b) "Orthopedic Viewpoint," Dr. Frank Dickson, Kansas City, Missouri.

(c) "Industrial Viewpoint," Dr. Fred W. Slobe, Regional Surgeon, Sinclair Oil Company.

AFTERNOON SESSION: "Sulfanilamide Treatment of Infections," Dr. O. P. Hampton, Jr., Assistant in Clinical Orthopedic Surgery, Washington University School of Medicine.

"Treatment of Compound Fractures," Dr. J. Albert Key, Professor of Clinical Orthopedic Surgery, Washington School of Medicine.

"Treatment of Burns and their Complications," Dr. Theo. L. Hansen, Chief Surgeon, Chicago, Rock Island and Pacific Railway, Chicago.

"Diagnosis and Treatment of Head Injuries," Dr. Wm. T. Coughlin, Professor of Surgery, St. Louis University School of Medicine.

"Diagnosis and Treatment of Pathology of Nucleus Pulposus," Dr. L. T. Furlow, Assistant Professor, Clinical Neurological Surgery, Washington University School of Medicine.

Round Table Discussion of Industrial Subjects: Hernia, Physical Examinations, Disability Evaluation, Compensability of Injuries, etc.

EVENING MEETING: Dinner: "The Dividends of Industrial Medicine and Surgery," Dr. Clarence D. Selby, Medical Consultant, General Motors Corporation, Detroit, Michigan.

"The Health of the Executive," Dr. E. V. Allen, Head of Section in Division of Medicine, Mayo Clinic, Rochester, Minnesota.

Morning Session

DR. LEO A. WILL, presiding:

Dr. Garold V. Stryker, presenting his paper "Occupational Dermatitis," stated that many dermatologists had become interested in this subject and that there had been a great increase in the literature during recent years. Great strides have been made in the diagnosis, prevention and cure of occupational dermatitis and, equally important, industrialists have recognized the value of this type of work.

The ease of exposure of various employees is an important point to remember, and it should also be added that 65% to 75% of the claims in compensation experience result from occupational skin affections of some description.

References were made to the Missouri law and specific provisions of this law.

Two case histories were cited, in which one man was exposed for a considerable number of years to the same material and another for a relatively short period of time, both developing a characteristic dermatitis of the hands.

Although in some instances a high degree of tolerance is developed, there is really no dependable way to estimate allergy previous to exposure.

Relative to diagnosis, usually the clinical appearance offers no clue to the source of irritation and this presents considerable difficulty in many instances. Covered areas, that is to say, areas which are normally covered during work, may also be affected. There may be considerable differences in periodicity of attacks; the factors of local infection and diet may also alter the clinical picture.

With regard to differential diagnosis, which may be exceedingly difficult at times, a detailed history is very important.

Patch tests should always be done and they are diagnostically important, but it should be reemphasized that they are not always reliable.

With respect to treatment, change of occupation may establish the etiological factors when the lesion disappears under such change — that may be one of the most important considerations in the treatment. Exposed parts should be protected with clothing or with a bland ointment and attention should be given to diet.

In the prevention of occupational dermatitis, the worker must be safeguarded in various ways: by the enclosure of processes; by the use of special clothing and protective devices; by the means of periodic examinations; by proper ventilation; by cleanliness methods, such as showers, lockers, and the like. It must not be forgotten that soap itself may become an irritant, or the various types of cleansers allied to soaps may be irritants.

DR. C. E. BURFORD presented the "Urological Viewpoint on Differential Diagnosis of Back Conditions and Pain." The urologist is frequently consulted with reference to pain in the back, because the patient frequently suspects kidney disease; however, this specialist is concerned primarily with structures below the diaphragm.

For purposes of convenience, the structures may be divided into the upper urinary tract, consisting of the kidneys and ureters, and the lower urinary tract consisting of the bladder and reproductive organs.

In affections of the upper urinary tract, the pain is usually unilateral and is usually caused by an

obstruction of some sort. Frequently reflex symptoms are referred to the gastro-intestinal tract. Pain is usually increased by exercise. Several cases were cited where treatment by nephropexy caused an entire disappearance of symptoms. Many cases of gastro-intestinal operations have been seen in the experience of the essayist. A careful urinalysis both in male and female should be done in all cases and catheretized specimens only of female urine should be analyzed.

The urogram may be of value, but is often disappointing; the retrograde pyelogram is much better because greater information is to be gained by the use of the latter procedure.

The relationship of trauma to kidney lesions was demonstrated by several case histories of boxers and wrestlers who had experienced such kidney damage after traumatic mishaps.

With reference to the lower urinary tract, the prostate is an important organ because it has been established that 60 to 80% of males show chronic inflammation of this structure. Other organs and conditions which have to be considered are the seminal vesicles, the spermatic cord, the testicles, varicocele, and hernia, as well as related structures, in reference to working out the problems of backache.

A series of excellent lantern slides of pyelograms, together with explanatory case histories, completed a very interesting presentation from the urologist's point of view.

DR. FRANK D. DICKSON presented the "Orthopedic Viewpoint in the Differential Diagnosis of Back Conditions and Pain." This dissertation was based upon experience with a series of 1400 cases.

Five classes of cases were outlined: (1) strain of muscles and ligaments; (2) irritation of fascial structures; (3) arthritis; (4) strain of joint; and (5) the protrusion of intervertebral discs.

In the straining of muscles and ligaments, there is dull pain; there is some limitation of movement, and there is usually a negative x-ray of the parts involved. Gradual voluntary exercise is of importance in restoration.

In the irritation of fascial structures, muscle massage may be indicated where pain is referred down the lateral aspects of the thigh. X-ray findings are usually negative. In the treatment, fasciotomy may be necessary.

In the arthritides, there is a dull persistent pain increased by spinal movements, which are limited. Pain is referred to the hip and also to the abdominal region. The x-ray findings show changes characteristic of the type of arthritis indicated. The Bradford frame has been found to be of considerable value in the treatment, with bed rest and appropriate physical therapy.

In strains of joints, there is often pain in the sacroiliac region which is referred down the posterior aspect of the thigh. There is limited motion and the x-ray findings frequently show a separation. In acute stages of the disturbance, strapping is frequently of help; considerable therapeutic assistance has been secured through the use of properly fitted belts.

The lumbosacral region is most proliferative in its production of this type of case. Here we may be dealing with increased angulation, defective articulation, sacralization of the fifth lumbar, spina bifida or spina occulta. The findings are much the same as in sacro-iliac disturbances. Traction or a plaster cast may be used for four weeks and then physical therapy should be instituted.

Because the subject of the protrusion of intervertebral discs is to be considered later on in the program, only a few words need be said on this subject. This type of disturbance is too often diagnosed when it is not present, although such things do occur. There must be accurate criteria for diagnosis and this must be supplemented by careful study.

In conclusion, only careful examinations and x-ray studies will lead the way to a favorable outcome in orthopedic cases presenting the necessity for differential diagnosis of back conditions and pain.

DR. FRED W. SLOBE completed the morning program, presenting the "Industrial Viewpoint in Differential Diagnosis of Back Conditions and Pain."

Back conditions are either traumatic or non-traumatic and the employer wants to know which. This necessitates taking an accurate history leading to a correct diagnosis, and finally permitting of adequate treatment.

The exact time and date of the pain onset, the exact details of work, and location of pain, are highly necessary. It is important that the employee be encouraged and requested to re-enact exactly what took place. It is vital to know if there has been any previous attack of similar nature, as to whether previous health has been good, particularly with reference to attacks of acute respiratory infection, as to whether any fever was experienced during such attacks.

The great fallacies that exist in working out these cases is false reasoning from cause to effect; this is really a fallacious interpretation of the sequence of events, with a tendency to blame an effect on a cause when it is not responsible, merely because it occurred after a causative factor. Many of these patients are quite sincere, but fallacious in their reasoning. In spite of this fact, there is little primary malingering.

It is extremely important to get all the facts early because of the difficulty produced by changes in ideas and opinions.

The patient should always be treated properly, but there is a definite difference between benevolence and legal liability. In this respect, it is wise to remember that real trauma causes some incapacity and a definite symptomatology.

Localized tender areas are always to be sought for carefully — in true traumatic cases they can always be found and they are important in selecting treatment.

In minor cases of injury, a great deal of work

must be done without the help of the x-ray. The average minor case recovers in 10 to 21 days, without pre-existing pathology.

In the general run of cases, operation is probably necessary in one out of one hundred cases, and one can find a protruding disc in probably one out of one thousand cases.

Rest is the most important factor in treatment. A great many cases can be sent home with instructions to sleep on a board in the bed and with instructions to bend at the knees only if necessary. Heat, massage, physical therapy in general, are great assets to treatment. Many instances occur where there are pre-existing factors which are precipitated by an almost insignificant event.

In regard to general measures, consideration must be given to obesity, diet, gout, anemia, a sluggish colon, focal infections, posture, and flat feet; all of these subjects are of great importance in working out the details of each case.

A series of excellent slides was shown, illustrating strapping methods and Steindler's method. Consideration was also given to muscular infection and also paravertebral injections.

In summary, the most important item in the treatment of the patient is the cooperation of the employer relative to the return of the employee to gradual activity; this is in itself a great factor in preventing difficult case problems.

In the discussion which followed, it was particularly emphasized that placement is a difficult problem in industry, in many different situations. Employers' point of view is a very important item. Attention should also be given to deformities and defects of the feet, particularly with reference to back conditions.

Afternoon Session

DR. E. C. FUNCH, presiding:

DR. O. P. J. FALK presented a survey of sulphur compound therapy — its uses and abuses.

In general, through the use of these compounds, the course of disease is shortened, severity and complications are cut down, and expenses are decreased for special procedures and operations.

Certain important principles must be kept in mind — there must be a definite indication for therapy of this type — there must be early application and sufficient quantity used — it must not be forgotten that these compounds only slow up the growth of organisms and do not actually build immunity or fortify the individual against the bad effects of infections.

As to special indications, sulfanilamide is of use in meningoccic and hemolytic streptoccic infection; pyelitis and urinary tract infections; erysipelas and scarlet fever. Sulphopyridine has a particularly bacteriostatic effect on pneumococcic infections; one should start promptly with the clinical picture in these infections, for it is important to keep a certain concentration in the blood; there should be combination treatment with serum therapy treatment in type III pneumococcic infections; indications for stoppage of the therapy present themselves in the symptoms of nausea, vomiting and headache. Neoprontosil finds its adaptation in acute fulminating cholecystitis cases, in ulcerative colitis infections, and in acute streptococic throat cases. Cyanosis may be controlled by the administration of methylene blue by mouth.

Sulphamethylthiazol is a new compound, but there have been some favorable reports on its use in urinary infections. We are unjustified at the present time in making any predictions, however.

In considering the abuses of these various compounds, there has been indiscreet use in colds and influenza which are virus infections. In bacterial infections, however, there is a distinct specific use. The use is contra-indicated in arthritis of the infectious, hypertrophic and atrophic types. Administration of these compounds without adequate laboratory control is always discouraged.

In summary, careful, thoughtful and conservative use of these compounds is necessary for their proper adaptation to specific and selected cases, to avoid difficulties.

DR. J. ALBERT KEY discussed the subject "Treatment of Compound Fractures."

In these problems, we are dealing with an open wound and pathogenic bacteria and the fact that the resistance must not be lowered in any way. Attention must be given to hemostasis, shock and splinting, before the patient is taken to the hospital. When in the hospital, hemorrhage, shock, immobilization, fluids, transfusion, heat, and regional novocaine are all matters to be considered. The cardinal principle of treatment is the prevention of infection rather than consideration of the fracture. This can be accomplished by adequate and proper cleansing, adequate debridement, and irrigation. Silk sutures should be used on severed tendons and other structures where practicable. Fragments of bone which are free should be removed. Internal fixation should be avoided if it is at all possible to avoid it. Most wounds can be closed in the first 12 hours, sprinkling sulphanilamide powder over the wound. Closure should be accomplished with deep silkworm sutures and the patient should be put in a cast.

In the discussion, Dr. C. A. WALKER, of San Francisco, agreed with the experience with the use of sulphanilamide in fractures. The evolution of surgery particularly with reference to the experience of the Southern Pacific Hospital Department was sketched by DR. WALKER, over a period of 30 years.

DR. KLINEFELDER agreed, in his discussion, with the principles set forth in the sulphanilamide paper. He believed that one could not do a good debridement in certain places, particularly around certain joints. He was throwing away pieces of detached bone. He makes use of counter-drains in many instances. He doesn't use metallic plates, but has had experience with taking out a lot of them.

DR. JONES in his discussion emphasized the importance of cleanliness and believes in some instances that simple cleaning methods are better

and in other instances, the use of antiseptics. He uses internal fixation but in certain cases thinks that it is not proper to use it.

DR. JAMES A. VALENTINE wanted to know more about DR. KEY'S ideas relative to pre-hospital treatment.

DR. FREDERICK SLOBE, in recalling the experiences of Kanavel, Koch, and Mason, recognized the preference for simple methods of cleansing and the general avoidance of the use of antiseptics.

DR. EDWARD HOLMBLAD recited briefly a case report about a compound fracture of the leg with subsequent gas bacillus infection. Although there had been previous use of a preventive serum, the infection occurred. It was explained that there probably was not a good primary debridement done in this case, and that this was finally responsible for the infection which came about.

DR. FALK, in closing, placed additional emphasis on combined therapy in pneumococcic infections.

DR. KEY, in closing, stated that a blood pressure of less than 80 means shock, which is accompanied by cold, clammy and pale appearance. A local aneshtetic should be used in such instances. He leans toward the side of operation rather than waiting. Sulphanilamide in distinctly bacteriostatic and is used routinely in wounds where metal and grafts are made use of — DR. KEY prefers metal screws to bone screws. One can use metal in a clean wound area with sulphanilamide and close the wound tight. The type of metal makes some difference nowadays, since improvement has been made. No use is made of antiseptics in the experience of DR. KEY. The best time to close the wound is when it is fresh. Where you can't close and when it is infected, at least the wound should be closed as much as possible. Sulphanilamide should be autoclaved. Routine use is made of anti-tetanic serum.

DR. L. T. FURLOW presented the subject, "Diagnosis and Treatment of Pathology of Nucleus Pulposus." In opening his discussion the work of Goldthwaite in 1911 and Middleton and Teacher in the same year was reviewed. Smorl's experience in 1927 was commented upon, Mixter's work in 1934 was cited. Since the work of these men, the literature has increased by leaps and bounds.

There is no doubt about the existence of this type of lesion. The probability is that it has been much over emphasized.

The etiology has a relationship to slipping or stepping down suddenly, sudden lifting, or sitting down hard — extrusions occur mostly in the lumbar region.

There is considerable low back pain and sciatica. The most constant reflex change is loss of ankle jerk on the affected side. Sensory changes occur around the buttocks and on the posterior aspects of the legs.

Diagnostically there is an increase of total protein in the spinal fluid (above 45 milligrams per cent). In taking a sample, the fluid should be taken down as low as possible.

The only definite diagnosis possible is by intraspinal lipiodol which localizes the lesion. Five cc. are used in the average adult and the fluoroscopic table should be used for localization.

The treatment in practically all instances is a small laminectomy with the removal of the protruding disc. At this time the lipiodol should be washed out of the spinal canal.

DR. KLINEFELDER wondered if lipiodol itself produced any symptoms.

DR. SLOBE asked if there was any difference in the total protein in different samples of spinal fluid.

DR. FURLOW, in closing, stated that when the reading of the total protein was taken before a Quackenstadt test was made, the reading was eight to 10 points higher. Of his own experience, DR. FURLOW didn't know that there was any harm done by leaving the lipiodol in the spinal canal, but he cited an orthopedic case where the removal abated symptoms complained of in that case. In one instance, as reported by Nafziger, the post-mortem examination showed no root changes after lipiodol had remained in the situ for many years.

DR. WM. T. COUGHLIN was unable to be present and deliver his paper on "Diagnosis and Treatment of Head Injuries."

THE last paper on the afternoon program was delivered by DR. THEO. L. HANSEN on "Treatment of Burns and their Complications."

The treatment of burns is an old subject, and reference was made to the literature of 1818 when basic principles were set forth.

Our later ideas lead us to believe that it is not reasonable to assume that primary shock is due to the absorption of toxins, but rather due to pain. Many now believe that secondary shock is not due to the absorption of tissue toxins.

The loss of 3500 cc. of fluid in the first 24 hours when approximately one-sixth of the body area has been burned is an important matter because if this loss of fluid is not promptly replaced, severe shock and death may follow. Since the fluid is similar to blood serum, transfusion may properly be done.

A very important consideration is the fact that bacterial contamination of the burn may occur within 36 hours. Pneumonia or nephritis are common complications and causes of death.

Treatment may be divided into general and local. The general treatment is by far the most important, particularly that which is directed to the treatment of shock (opiates, heat, and the like), and the restoration of fluid (by the use of salt solution). The simplest way of course is to give a transfusion. Local treatments consisting of tannic acid, and gentian violet preparations have been used in many instances. The coagulum formed by tannic acid, however, presents several disadvantages, particularly with reference to the easy occurrence of infection, and as a deterrent to the prompt repair of tissue. Cod liver oil ointment gives far better results without the disadvantages. Infra-red therapy is preferable to tannic

acid preparations. Prevention of contractures by extension and other methods is also deserving of mention.

In summary, systemic treatment includes attention to shock, restoration of fluid and chloride balance; local treatment may be accomplished by many different methods, which are matters of opinion and choice by various surgeons using them.

Round Table

IN THE brief round table discussion which followed the regular presenation of subjects, attention was given particularly to hernia and physical examinations, with Drs. Slobe, Holmblad and Hansen contributing.

It was the general consensus that the injection method of treatment in hernias can be applied to selected cases, particularly to the small and early hernias, and where general anesthesia and operation are not feasible for various reasons. Operation, however, is preferred in most instances. When using the injection method, it is recognized that there is no hazard, no mortality, and no morbidity, but a well-fitted truss which must fit for 24 hours in a day must be applied and worn for four to five months, otherwise the method is not efficient.

The problem of examination for hernia presents certain difficulties. It is always well to examine a man in the standing position and ask him to strain as if moving his bowels.

Dr. Holmblad demonstrated the chair and weight-lifting test. It is of great importance to have the statement of two doctors on the preemployment examination. One is of necessity compelled to rule out all causes of intra-abdominal pressure, such as stricture and prostatic obstruction; this can easily be seen because it is no use to operate on a hernia, if the cause of intra-abdominal pressure behind the hernia is not removed. Differences of opinion may occur, but if the simple principles previously discussed are followed, these will be greatly obviated.

The question of sugar in the urine was very briefly discussed and, in this respect, it was stated that a fasting blood sugar over 130 and a glycosuria are the important points to be kept in mind.

Evening Meeting

DR. C. D. SELBY in discussing "The Dividends of Industrial Medicine and Surgery," stated that it is of great importance to be interested in sickness which is not ordinarily attributable to industry and not ordinarily charged to industry, because all of such types of sickness have an influence on the capacity of the individual for work and these types of sickness are the greatest sources of absenteeism.

The older employee is a problem that industry must solve. Many of these think that they are just as good as they ever were. However, it has been shown that 44% of persons over 35 years and 55% over 50 years of age have a limited capacity for work, as compared with their former efficiency. There are many types of chronic disease which are the background for these difficulties.

Comparisons have been made showing that in military experience 25% of persons from 18 to 24 years of age are physically unfit for active military services. Similarly in a representative group, 8000 persons lose eight days a year on account of illness, of which 50% is due to respiratory disease and 15% to digestive disturbances.

Additional figures show that 20% of new employees are unfit for military service; employees 40 years and over in age have lost about 40% of their original capacity; each year about 10% of industrial employees are absent about eight days or more on account of sickness.

In a program of industry for the conservation of the health of employees, the following items are of great importance:

1. In doing various types of examinations, the physician has great responsibility and should be permitted to go as far as necessary in the examination procedures. Records should be kept privately.
2. An adequate system for the recording of absenteeism from sickness should be established among the employees.
3. Control of harmful exposures is an important item in the preservation of health.
4. Periodic check-ups for the purpose of discovering new conditions which arise from time to time.
5. Temporary relief for minor ailments.
6. First aid in urgent illnesses.
7. Check-up after return to work.
8. Adapting men after sickness.
9. Cooperation of family physician.
10. Cooperation with official health agencies.
11. Cooperation with workmen.

In summary, it can be stated that absenteeism from sickness can affect the quality and quantity of production very definitely and that the humanitarian aspects of this work mean better health as dividends to any organization.

DR. E. V. ALLEN spoke on "The Health of the Executive," giving a very vivid picture of the tired business man. The average expectancy has increased but very little in men over 40 years of age.

A lot has been said and done about periodic health examinations, but in many instances these fall far short of what they should be. The physician is remiss unless he knows in addition to the diagnostic findings, the habits and reactions of the individual to life.

Three important aspects of the life of executives were considered, food, use of tobacco, and the use of alcohol.

It is acknowledged that everyone, at least almost everyone, eats too much — the race is to the thin, and not to the strong. The United States has the highest incidence of diabetes of any country in the world, which means that most persons should consume less fats and carbohydrates. Another important dietary error is the fact that we eat by the clock instead of when we are hungry.

A survey of users of tobacco has shown that the temperature of the skin is decreased in heavy smokers; that there is a reduction of the caliber of the small arteries, that dimness of vision is produced, that the blood pressure is raised, that nicotine is found in the blood and the urine in increased amounts. It should be remembered that nicotine has the same order of toxicity as hydrocyanic acid. There is no real answer scientifically to this problem, but probably one can say with safety that tobacco is not really beneficial.

A small amount of alcohol has been considered harmless, the difficulty is restricting one's self to this amount. Many people feel the need to be lifted out of themselves and most drunkards have been proved to have a psychopathic personality.

The manner of living of many executives impairs their health. They fail to take the long view of things, planning only for the next day. In connection with these principles, Compton, Lin Lu Tang, and Edgar Guest were all quoted.

It is important to remember that the humorous person can envisage the larger things. The business executvie as a rule lacks real vision — all nature loafs when man bends his back in toil.

The remedy lies in cutting down on excess of tobacco, alcohol, and food. But how can one avoid tension? Where does one get by working hard? Does success bring happiness and contentment

There must be more of the spiritual attitude and there must be more vacations — perhaps three days each month would be better than taking a lot of days of vacation successively. There is much to be said for the "retreat" from the problems of life. Hobbies are to be encouraged. There should be more physical work, more handwork, more play for recreation's sake, more peace, contentment, and relaxation.

It appears that many would rather run along for 50 to 60 years and achieve many things than to be moderate and live to 65 or 75.

The final formula for longevity has been suggested by Pearl. In many observations, the broadest generalization that can be made is that the great majority of persons who live to ripe old age had a placid temperament and that length of life is inversely proportional to rate of living.

From the Archives

—*A Diagnostic Study of Industrial Medicine*—

BEFORE proceeding to a definite discussion of various factors in industrial medicine some allegorical references may be in order.

An Allegorical Reference

INDUSTRIAL medicine, a struggling youth of 20 years comes to us complaining of headache, palpitation of the heart, pains in the muscles and joints, loss of weight, and a feeling of general weakness.

The family and personal history show a gradual development of activities with the usual childhood and adolescent difficulties.

In the physical examination of this patient, let us assume that the medical profession represents the head. We find that the eyes show a considerable degree of myopia; the hearing is definitely impaired in both ears; a further examination of the right eye shows the presence of a sarcoma of the fee-splitting variety. Mental tests give the impression that there has been lack of coordinative planning and administration.

Let the heart represent industrial executives. Here there is a definite valvular leakage and there are "missed beats" and palpitation on the slightest exertion.

The lungs correspond to industrial commissions and boards. The findings show considerable dullness, whispered bronchophony and many fine rales at both apices.

The nervous system is represented by the insurance carriers. Examination shows the reflexes exaggerated at one time and inhibited at others; the pupils are unequal and sluggish in reaction; the Babinski and Romberg are positive, and the ankle clonus is increased.

The working population is synonymous with the muscular and skeletal systems. Much muscular incoordination is evident; the posture is poor; there is a definite atrophy of certain sets of muscles and hypertrophy of others.

Without attempting to carry the allegorical application any further, and submit laboratory findings which would probably only confirm this brief presentation of the physical findings, I think that we can safely assume that this is a fair clinical picture of our young patient, industrial medicine of today.

Now let us discuss briefly the application in relation to industrial medicine.

Significance of Industrial Injuries and Illnesses

WITH approximately 50 million persons gainfully employed in the United States, and the loss from illness in industry totaling 10 billion dollars a year, there must be definite reasons why industrial medicine has not assumed a more important place in our national life.

Speaking conservatively, there must be approximately 20 thousand industrial physicians and surgeons in actual practice, and yet after 15 years a representative national organization in industrial medicine and surgery has approximately a membership of only 325. Three other official and unofficial organizations have sections on industrial medicine the membership and attendance of which has never reached more than 100 each.

It would seem that the great opportunity lies in feeding a regular and nutritious diet of information and principles to the great number of part-time industrial practitioners and the welding of them into a homogeneous and coordinative group. Similarly, another great need lies in providing an

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By C. O. SAPPINGTON, M.D., DR.P.H.; from the Division of Industrial Health, National Safety Council, Chicago; given before the Sixth Annual Meeting of the Michigan Association of Industrial Physicians and Surgeons, at Detroit, April 23, 1931; published in *California & Western Medicine*, December, 1932.

adequate type of medical and health supervision for the employees in the great number of small plants constituting 95% of all of our industrial groups.

Then, too, we must provide educational opportunities for undergraduates as well as postgraduate courses. This should be done on a national basis by a body whose authority and recommendations would be unquestioned. Certification of specialization on an optional basis would then be a natural development.

Industrial Executives and Commissions

INDUSTRIAL executives and administrators as a rule are apparently unaware that it is their responsibility to provide safe and healthful working conditions for their employees. I have observed numbers of manufacturers who do not have adequate knowledge either of the processes or materials to which their workmen are exposed. It might be well here to mention the inseparability of safety and health work; their objective is the same, namely, protection; when safety and health supervision break down, the results are the same—disability, reduction of earning power, and economic loss both to employee and employer. Injuries may be classified as mechanical, thermal, photic, chemical, electrical, and bacterial, which means that there is no hard-and-fast line separating safety and health procedures. Finally, the causes and results of both illness and accidents are definitely concerned with the human body and mind.

Some industrial commissions have done excellent work, but I think most of us will agree that there is room for much improvement. The outstanding defect seems to be the disregard of respect for sound medical advice and the lack of provision for retaining one or more competent physicians as technical advisers. Any commission has the right to ask industries within its jurisdiction to make definite and specific provisions for the protection of the health and safety of employees; but, logically, it must also set up the mechanism by which such standards can be continuously supervised and maintained. I have recently had an experience which strikingly showed an elaborate preparation for the former, but an utter disregard for the latter.

Insurance carriers, with all their previous difficulties, are now finding new complications in the tremendously expanding field of underwriting new health risks. A considerable number of those who are honest admit that the technical difficulties involved are quite beyond their present capabilities, but they are doing what they can. In common with industrial commissions, they probably will eventually see the wisdom of retaining expert advisers on industrial hygiene; failure to do so will probably lead to economic difficulties and eventual annihilation in this increasingly competitive field.

The day of the "big stick" has passed; we are on the doorstep of an era when the individual employee will more and more seek what he thinks are his "rights." Is it bolshevistic for an employee to seek protection against the hazardous materials, processes, and practices to which he is exposed? Shall man-power be subordinated to production and monetary gain?

Prognosis for Industrial Medicine

POSSIBLY I have painted a very pessimistic picture. Really, however, the prognosis for industrial medicine is quite favorable with the appropriate type of therapy. The great problems of industrial health and safety will never be solved until the emphasis is shifted from curative surgical and medical procedures to the preventive phases—not that the former are unimportant; in truth, the two cannot be dissociated.

There is cause for encouragement; a rainbow has made its appearance on the horizon. Of the approximately 3000 advisory letters written each year by the Industrial Health Division of the National Safety Council, 20% refer to physical examinations; 60% embrace chemical health hazards; the remainder refer to miscellaneous subjects. We have an increasing number of calls for health educational and informational material, and for suggestions for the carrying out of health courses and campaigns in industry. An increasingly larger number of questions are coming to us on the sociological problems of industrial health. A large industrial association has prepared a manual on health and first aid for distribution to its members.

We also have requests for actual statistical data showing the beneficial results accruing from employment physical examinations, periodic re-examinations, the correction of physical defects, and the like. Such figures are obtainable only in rare instances and I do not need to further impress upon you the difficulty of showing tangible returns. The keeping and analysis of records is time-consuming and expensive, but such data must be provided if we are to establish the economic necessity for medical and safety services.

The administration of industrial medical programs shows all the permutations and combinations that are possible on a Chinese lottery ticket. Industrial relations groups claim that they are responsible for the administration of industrial medical and safety services; safety departments feel that medical and health procedures belong under their jurisdiction; it is comparatively rare, but has occurred, that a physician has undertaken the management of all three activities. Probably the ideal arrangement is to place all three departments on an equal authoritative basis and make them all directly responsible to the general manager. I can see no large measure of success for any unless all three activities are constructively coordinated.

Economists tell us that within the next five years efficiency will be increasingly emphasized and in meeting greater competition the industry which is most efficient will make the most progress. Certainly there is a direct relationship between health and efficiency, and I would interpret this to mean that more emphasis will be placed on health.

End To Be Achieved

FINALLY, I think that we can feel that this young man—industrial medicine—has a real chance for making a name for himself and building a character and reputation worthy of the consideration of other medical specialties. We envision, not an industrial world where employees live by health rules and become veritable hygienic robots — God forbid — but workshops, market places, and stores where employees will be given the opportunity to achieve the birthright of every useful citizen—a sane mind in a sound body.

Dark Adaptation

—Its Place in Accident Prevention—

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DARK adaptation is the ability of the eye to adapt itself to see in darkness.

Should one sit in a well-lit room and have the lights suddenly extinguished, objects and people in the room are indiscernible at first. They then appear with increasing clarity with continued stay in this darkened room or auditorium. The same is true of walking from a sun-lit street into a darkened chamber.

To Aubert[1] in 1865, is given the credit of first describing this phenomena, and to Piper,[2] 1903, the acknowledgement for being the originator in scientifically measuring dark adaptation in individuals. Since these two investigators, an increasing number of ophthalmologists, biochemists and medical clinicians, have concerned themselves with this subject both in America and abroad.

At the present time it is conceded[3] that vitamin A bears a relationship to visual purple, the factor important in the phenomena of dark adaptation, and that the liver[4] is the storehouse of vitamin A.

The physiology of dark adaptation can be briefly explained in this manner: The sun or light bleaches the visual purple in the retina of the eye —here the cones in the retina are responsible for vision, and the person can then see clearly in daylight. On entering a dark room, the visual purple becomes spontaneously regenerated the longer one is in the dark room. Vision in the dark is accomplished by the rods of the retina aided by the regenerated visual purple.

A marked delay in the process of dark adaptation is pathologic and is brought about either if the retina or deep choroidal structures are diseased, viz: retinitis pigmentosa, choroiditis, etc., intra-ocular pressure (on the rods) glaucoma, disease of retinal vessels disturbing retinal function by interfering with the retinal blood supply as in retinal arteriosclerosis, etc. This type is the *organic* type of pathologic dark adaptation.

If, however, this delay in dark adaptation is of abnormally long duration but the fundus oculi is normal, as seen by ophthalmoscope or like apparatus, the condition is a *functional* one and may be amenable to cure by vitamin A. The *organic* pathology of dark adaptation however, is incurable although there may be some improvement under treatment.

Devices for taking dark adaptation should have definite constants. To mention a few of the constants, for example, the pre-exposing light, (A) Fig. 1, and the light target, (C) Fig. 1, must each be of uniform intensity and wave length. The use of a rheostat should not be permitted at any time, since either the wave length or the light intensity is altered thereby.

The area to be examined for dark adaptation should be the area of the retina where rods are most abundant up to 20° from the macula. The examiner must be able to see the subject keeping his eye open during the light adaptation.

To meet the scientific requirements given above, I have devised two machines. One is a quantitative apparatus, wherein a number of readings of light threshold are usually taken for at least 30 minutes. The plotting of the curve of the dark adaptation test takes about one-half hour additionally. It is valuable where laboratory or research studies are made, since it gives, with precision and accuracy, threshold readings in minutes or multiples thereof for as long a period as desired. It is impractical because of the time element involved in performing the study.

The other contrivance is a practical device and a clinically useful one. It is so devised that a normal study can be effected in from three and one-half to eight minutes. It is constant in its readings on the same individual when studies are taken at different times, and also shows a consistency (95%) when its results are compared with that of my more elaborate quantitative device. The results are given in a single figure—the light

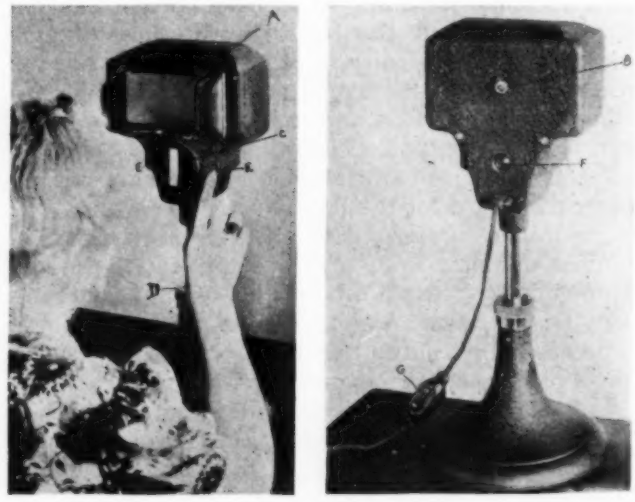

Fig. 1. American Optical Company Adaptometer. Left: Front and Side View. Patient is in a dark room; has had pre-exposure. Now instrument is raised so that target is on level with eyes. Head is nine inches from instrument. Finger is placed where patient is looking. Right: Rear View Adaptometer Showing bulls-eye (F) to determine if apparatus is working, and switch (B) to turn light from pre-exposure to light target

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From the Eye Department of Episcopal Hospital, Service B, and St. Christopher's Hospital for Children, Philadelphia, Pennsylvania.

threshold. This reading should be within five minutes. It is *absolutely* important however, to follow the technique carefully. The machine and its use comprise the following:

In the technique of dark adaptation the pre-exposure of the eye, also called light adaptation, must be for a specific period of time. In all cases, less than two minutes is not permitted since the bleaching is not complete.[5] Usually, at least three minutes are desirable for pre-exposure. The operator should see that the subject has the eyes open continuously.

It is important that all parts of the eye be bleached out.

Accordingly the subject is instructed while looking into the pre-exposing chamber to look extremely to the left, right, up, and in, for about one-half minute each time during the three-minute pre-exposure period.

It has been noted that individuals during their study of dark adaptation were normal in an extraordinarily short time if instead of looking at their finger (see technique) they looked at their very extreme right or left.

The reason for their seeing the light inordinately soon is that they used the retinal area which was not well "pre-exposed."

While it is always difficult to detect one so canny, a good rule is to question a light adaptation reading obtained in too short a period of time.

Thus, for example, where the dark adaptation is one-half minute or less (normal five minutes) it is advisable to repeat the test and see that the subject, while being pre-exposed, looks into the light in the extreme right, left, up and down, and also diagonally.

In the machine, "A" is the pre-exposing or light adaptation chamber. The patient places his head near enough into the enclosure to permit of his eyes being observed by the examiner. After the light is on for three minutes it is extinguished by pressing push putton "B," which automatically illuminates threshold light "C" which can be rotated in any position unbeknown to the one examined.

The head of the apparatus is raised by turning "D" and placed so that "C" is on a level with the subject's eyes. The subject is now placed nine inches from the machine and his finger is put at "E," and he is told to look in the direction of his finger.

The *very instant* the subject sees the faintest beam of light (he must not wait till the light becomes bright) he must say *"stop,"* the switch "G" on the cord of the instrument is pushed. This turns out all the lights.

The subject is then asked which way the beam went, whether up, down, or oblique. This acts as a check as to whether the subject did or did not actually see the light.

The bulls-eye at "F" indicates in the dark whether or not the light in the light threshold chamber is working.

If there is any doubt as to the validity of the answers, the patient may have the light turned on in the room or go into the street for several minutes and the test may be repeated. The taking of dark adaptation need not add to the burden of the examining physician, since the test can easily be done by a technician and only the pathologic cases need to be examined ophthalmologically to determine the condition of the retina.

Vitamin A Deficiency and Adaptation

THERE is quite a good deal of evidence of the clinical relationship between avitaminosis A and pathologic dark adaptation. I have previously cited a few cases.[6] Recently I had a most interesting experience. I was asked to do a dark adaptation test on a woman pregnant five months. She was struck by an auto three months previous to seeing me. She still bore the bruise when she first visited me. When I saw her she claimed she did not see the automobile even though the accident occurred when it was not yet very dark. Two weeks before coming to see me, her life was saved by a friend who pulled her quickly from the path of a speeding car before which she was walking. She stated she did not see this vehicle either. Since that time she had definitely noticed that as soon as darkness appeared her vision became very poor. She consulted her obstetrician at one of the large institutions in Philadelphia who referred her to me. Her dark adaptation was pathologic. She was placed on a high vitamin A diet together with hypodermic injections of 50,000 units of vitamin A each. Her dark adaptation as well as night blindness improved in a period of over three weeks.

I am indebted to Dr. Ezickson, of Philadelphia, for the following personal experience: A woman who had kidney stonse always persisted in driving to the left of the street, she could not see the right curb at night. She was put on a corrective diet both for her avitaminosis and her renal calculi, and was later operated upon and several stones were removed. She is now perfectly well of her renal condition and is not night blind. Her dark adaptation is normal now, whereas it was definitely pathologic before.

A railroad engineer with kidney stone was involved in two wrecks at night. One night while walking in front of his home he did not see a plank and fell over it breaking his lef. Here also, as shown by Dr. Ezickson, there appears to be a definite relationship between renal calculi disease and night blindness.

Manville,[7] using the American Optical Adaptometer, reports two interesting cases in his experience, as well as one by Wilbur and Eusterman.

A young man aged 34 years, while driving at night had great difficulty seeing both the road or people clearly. The lights of passing cars annoyed him. His diet was deficient in vitamin A. A dark adaptation test was pathologic. Treatment with carotene improved both his dark adaptation and night blindness.

Another man desiring to reduce his weight, placed himself on a deficient diet, developed clinical symptoms of A avitaminosis. He saw poorly

in the theatre and at night while driving. His dark adaptation was pathologic. His condition improved entirely on several weeks of treatment.

Pett,[8] cites the interesting case of an airport attendant who could not see a dim light attached to a meteorologic balloon.

He was found to be suffering with avitaminosis A, and after being treated for this, made a successful recovery.

The experience of Dr. Ezickson and myself in the examination of 75 drivers arrested in Philadelphia for accidents, is worthy of mention.

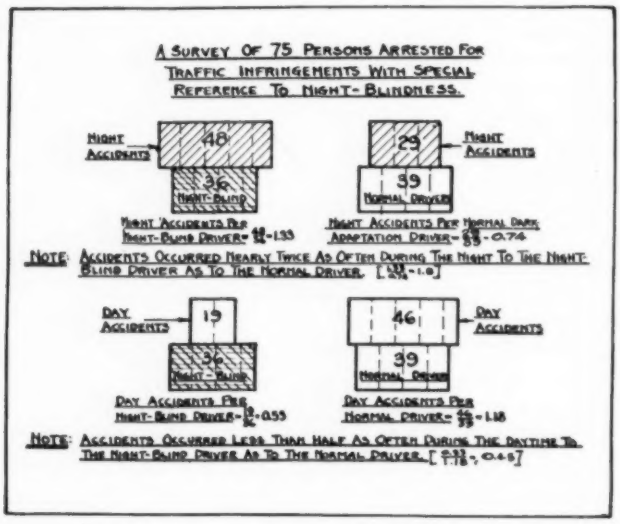
A Survey Of 75 Persons Arrested For Traffic Infringements With Special Reference To Night-Blindness.
Night Accidents
46
36
Night-Blind
29
Night Accidents
39
Normal Drivers
Night Accidents Per Night-Blind Driver- 46/36 = 1.33
Night Accidents Per Normal Dark Adaptation Driver- 29/39 = 0.74
Note: Accidents Occurred Nearly Twice As Often During The Night To The Night-Blind Driver As To The Normal Driver. [1.33/0.74 = 1.8]
Day Accidents
19
36
Night-Blind
46
Day Accidents
39
Normal Drivers
Day Accidents Per Night-Blind Driver- 19/36 = 0.53
Day Accidents Per Normal Driver- 46/39 = 1.18
Note: Accidents Occurred Less Than Half As Often During The Daytime To The Night-Blind Driver As To The Normal Driver. [0.53/1.18 = 0.45]

Fig. 2. Analysis of 75 persons arrested for accidents in Philadelphia

The night blind individuals had one and one-half times as many accidents in the night time as the normal dark adaptation cases, and a somewhat less than one-third the day accidents as the normal dark adaptation, showing that the night blind driver is a careful driver but that his accidents at night are caused particularly by his affliction.

That the subject of dark adaptation is engaging the attention of the medical and lay-public is evidenced by an article by Griffith[9] who quotes Dr. W. W. Bauer to the effect that night blindness is the cause of fatal accidents, and as being one of the early signs of vitamin A deficiency. A transportation magazine[10] carried an article on dark adaptation in 1938. Intensive courses in ophthalmology include a course in dark adaptation. One of these courses were held recently in California, another is given by the Philadelphia County Medical Society Eye Section, a third is included in a post-graduate course in Aviation Ophthalmology held in Washington, D. C., on April, 1940.

To show graphically how accidents happen to a night blind individual, I have had drawn the common scene often encountered on the highway.

It should not take much stretching of the imagination to anticipate the likely accidents which may occur. This depends almost entirely on the rate of speed at which the cars are going, with also the factor of the individual's response to a danger, depending on alertness, calmness, ability to think and act quickly. Then too, the stopping distance for a car on a dry, concrete road, going at a certain rate of speed, is quite at variance with that of a vehicle on a wet or icy thoroughfare. For example:

Minimum Stopping Distance In Feet

Miles per hr.	Concrete Dry	Concrete Wet	Ice
20	38	44	88
30	68	83	183
40	107	133	311
50	153	194	472

Added to all this, and of primary importance to the driver at night, is the rate of ocular recovery in the normal and pathologic dark adaptation patient.

Pathology of dark adaptation is much more common than the average person would think. We have found this condition quite common in such constitutional diseases as goitre,[11] hepatic cirrhosis,[12] and calculi.[13]

There are however some few patients with pathologic dark adaptation who claim they are not night blind. The question is, how can these dark adaptation studies be evaluated?

The examiner for railroad, bus, and transportation companies is in an enviable position to do some practical clinical investigation to clear up this difficult problem which will never be solved by the laboratory investigator. By his close contact with the individual examined, he will know of previous sickness or accidents. Either of these

Fig. 3. A Common Occurrence on the Highway Car A (see hub-cap) may get off road and hit fence or hit car C which was not seen. Car B may get off the road also, on account of delayed recovery if he is the night blind individual

may be the cause or effect of night blindness. How often do we see individuals who are night blind and yet are unaware of their condition? Many times a person deaf in an ear, or blind or cross-eyed uniocularly, is discovered during physical examination, and is surprised when informed of the condition. Ordinarily, night blindness gives

a five- to seven-minute pathologic dark adaptation. Constitutional diseases without night blindness give higher pathology of dark adaptation.

As has been mentioned, examiners by their association with employees and their numerous examinations, are in an excellent position to determine the possible relationship between pathologic dark adaptation and night blindness.

The study of dark adaptation has unlimited uses. It will be found of value to railroads, trucking companies, bus lines, state police or state highway departments examining drivers for licenses or those involved in accidents; steamship lines, aviation lines, insurance companies. U. S. military forces, the Department of Commerce (civil aeronautics division), auto clubs, industries working at night, industries where employees work under strong lights, mining industries, transit lines, and fire and police personnel.

Summary

IN THIS article, I have determined to give a brief history, physiology and pathology of dark adaptation.

The description of a clinical instrument, a technique, and its uses in the industries, are also given.

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Initial Treatment of Industrial Accidents

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ALL wounds not made with surgical intent are infected. Yet the majority of lacerations, if promptly and properly treated, heal by primary intention. Those we expect to be clean often become infected while those we expect to be infected, often heal rapidly. Individuals vary greatly in their power to resist infection. Some wounds heal with almost imperceptible scars, while others develop ugly keloids. To me, behind the whole process, there are many mysterious manifestations which, as yet, we have not begun to understand.

One thing stands out forcibly however, and that is time. It is an all-important factor. Meleney,[1] in a recent article stated "after the first hour, the danger of infection increases rapidly." Moorhead[2] and others, have pointed out "the golden period for the treatment of infections is within the first six hours." We are all familiar with these things. Yet, is it not our duty as industrial physicians and surgeons constantly to bring before the public the absolute necessity of prompt medical attention?

Can Infected Wounds be Made Sterile or Surgically Clean? Certainly not by daubing the surface of the skin with iodine or rouging the wound over with mercurochrome. Our experience has proved that more organisms can be washed away than can be destroyed chemically. We know of no better solution than tincture of green soap and water and then more green soap and water. It is messy, it takes time, and I willingly admit that in most instances we are quite content to thoroughly cleanse the depths of the wound with iodine and apply a dry dressing. Some smear the wounds over with grease. I confess I never have favored ointments except for extensive wounds where the changing of the dressing would be nothing short of cruelty. Permit me to cite a single case in an attempt to prove the effectiveness of green soap and water.

Case Report: Four months ago, I treated a young lady for a laceration extending from the eyebrow nearly to the vault of the skull. The tissues were macerated and the periosteum looked as though it had been burned. In it were embedded flakes of black paint from the automobile which struck her. The skull was fractured and spicules of bone penetrated the brain. We lavaged the wound with several quarts of green soap and water and finally with warm saline. Primary union occurred and today, across a room, the scar is scarcely perceptible.

During the World War we experimented with Carrel-Dakin solution. Several officers from our hospital were sent to study directly under Dr. Alexis Carrel. After they returned, four wards of 60 beds each were set up to carry out an experiment. Exactly the same technique was used in each ward. All dressings were done with gloves and special instruments. Tissues were handled *very gently.* This, to my mind, was most important. In two wards, the Carrel-Dakin solution was used. In the third, a weak solution of bichloride of mercury; in the fourth, ordinary saline was irrigated into the wound at the same speed and the exact same temperature as that of the Dakin solution. It was my personal impression after watching the wounds for many weeks, that the physical effects obtained from the warm gentle irrigations were far more important than the chemical character of the solutions used.

The work of Allen[3] and others seems to indicate that no drug is superior to tincture of iodine in its power to kill micro-organisms. Sulphanilimide seems to be nothing short of miraculous. However, this is not a drug to be used routinely. Its local application in the form of a powder on a

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Read before the Meeting of the Association for Advancement of Industrial Medicine and Surgery on January 11, 1940.

wound surface requires further study. It might be administered as a prophylactic measure. This was done in the extensive fracture of the skull which I have just reported. Some of you are probably saying that it was the drug which prevented infection. I still contend it was the green soap and water that did the trick.

Debridement is a very delicate operation. It should be undertaken only under the best of light and with adequate assistance. Only dead tissues or those about to die should be resected such as ragged pedunculated bits of fascia and dark macerated muscle which has lost its power and contractability. A wide ruthless dissection through healthy areas may only open up new paths for the invading organisms.

Should Infected Parts be Immobilized? We speak of immobilization in the handling of fractures but I have come to feel somehow there is a brief period during which an infected process should be kept quiet. During this stage, it may be a mistake to insist upon voluntary exercise and surely passive manipulations are contra-indicated. You argue that exercises promote drainage and improve circulation. Quite true, but is it now possible that exercise might spread the infection? I feel quite strongly that squeezing of the parts to express pus not only traumatizes the tissues but also breaks down the leucocytic walls which nature is erecting. When all is said and done, as physicians, all we can hope to do is to assist nature. If you will pardon a personal reference at this juncture, I might add that on several occasions I had a prolonged series of boils. Those I squeezed spread; those I kept quiet did well; and those which were incised by my colleagues, invariably did badly.

Can Organisms be Destroyed by Light, Heat or Cold? It is admitted most bacteria thrive in dark places or at least they do not like the sun. Dr. Graubard's work[4] of using a slit-like ray of ultraviolet light directly on the wound is developing considerable interest. In boggy-water-logged wounds perhaps the infra-red rays may be beneficial. All things move in waves. We had the "long wave" and now we have the "short wave." We had the "heat wave" and now we have the "cold wave" (in more ways than one). The idea of freezing an entire individual may be proclaimed as being new, but I have heard a number of elderly practitioners relate how they saved extremities by packing them in ice. Far be it from me to contradict the claims of an honest man when they are based upon his own practical experience. I am willing to give diathermy credit for promoting the absorption of calcium deposits such as those found in the sub-deltoid bursa. On the whole, however, it is my conviction, physical or physio-therapeutic procedures are more beneficial in chronic than in acute conditions.

I have omitted mentioning heating the whole body in order to elevate the general body temperature. In generalized infections this may be beneficial but not as a part of the initial treatment of industrial injuries. On the other hand, if you are social-minded enough to believe that the rubbing of a knee against a garbage-can will produce an acute rheumatoid arthritis, or that in a right handed man what they term "the trauma of usage" will localize a gonorrheal infection to the right wrist, then of course, anything can happen.

Many patients do Not Report Infections for Several Days. What Should be Done in Cases of this Nature?

I am an old-fashioned salt water doctor. I am quite convinced that continuous hot soaks will *soften the skin* and bring about localization. Carefully note I said "continuous and hot wet dressings." One *must* wait for localization. After it has occurred, *there is no form of treatment which can replace adequate drainage.* Following operation, again I know of no better treatment than continuous hot wet dressings. Permit me to warn you against infiltrating infected areas with a local anesthetic. A few disastrous end results should be enough to convince one that the administration of a general anesthetic in a so-called "trivial case" will, in the long run, take care of the additional cost and perhaps hospitalization.

Regarding Closure of Accidental Wounds. A surgeon in closing a wound takes upon himself a grave responsibility. Many wounds if left open, heal kindly. The insertion of a small rubber band is not likely to produce a disabling contracture or a disfigured scar. We all have seen the results of too tight suturing, even in non-infected cases. Remember when swelling occurs, the sutures may tighten until they cut into the skin and prevent its proper nourishment. I shall never forget seeing a superficial half-inch laceration closed with four interrupted sutures. There was not room for all of them, so one was placed through the normal skin adjacent to the wound. At the risk of being ridiculously elementary, never use two sutures where one will serve the same purpose.

Infections, in a certain sense, *are like the measles.* They have an incubation period and run a definite course. I am not at all convinced this course can be materially shortened. I do feel though that we must always be on the alert watching for the development of complications such as a spreading into new spaces, a lymphangitis or adenitis, the destruction of nearby one and invasion into neighboring joints.

We should never forget we are treating the individual as well as localizing the lesion. It may seem far fetched to believe that a good cathartic and plenty of fluids would, by remote control, favorably affect a finger. I cannot help feeling that liberal doses of soda bicarbonate, in certain instances, might prove more effectual, than repeated ill-timed, poorly placed inadequate incisions.

OUR second major problem is *the initial treatment of fractures.* I can do little more than reiterate a few well accepted rules. Why repeat "trite axioms?" My answer, is because they are constantly broken.

First—*immobilize the joint above and below the*

fracture site. This rule, in my experience, is frequently forgotten in fractures extending across the middle of the forearm! Short splints not extending above the elbow will not by any stretch of the imagination prevent rotation.

There are exceptions to this rule. For example:

1. In fractures of the Colles' type there is no necessity for immobilizing the elbow.

In fractures in and about the ankle, there is no need usually to restrict knee motion.

2. Unnecessary immobilization should be avoided. There is no reason why in a Colles' fracture, a splint should extend to the finger tips nor why an ankylosis of the toes should be permitted to occur in treating a fractured femur.

Why, in many fractures of the forearm, are schedule losses made for limitation of shoulder motion?

3. *Splint 'em where they lie!* Here we must recall the possibility of converting simple fractures into compound ones. We have seen this happen in excellent hospitals. We must also remember that additional damage may be produced to the soft parts especially the nerves. Unless immediate immobilization is brought about and proper traction applied, angulation and overriding are bound to occur. The rule "splint 'em where they lie" must always be applied in injuries of the back and neck. Can you imagine what may happen to a compressed fracture of a vertebral body if the patient were placed in a crouched position and then jostled over rough roads?

4. *Early reduction is easy reduction.*

If we could only convince our house surgeons that a displaced fracture is as much an emergency as the ever-glorified glamorous appendix, we would have accomplished something. Before extensive swelling and muscular spasm develops, it is surprising how the fragments of a badly displaced comminuted fracture will fairly fall into perfect position. One can actually feel the reduction. How different the picture is the following day.

5. *Do not use casts where splints will suffice!* Here I wish to sound a warning about tight casts on the forearm. It only requires a short time to produce a Volkmann's ischemic contracture. I know of no method to correct the ghastly deformity of a claw hand.

6. *Avoid open corrections!* (Do not be tempted by the fact that the fee schedule has placed a premium on open reductions). If closed manipulations are impossible or seem impractical, resort to skeletal traction. Recently, I received a request from a city up-state to perform an operation. The man had fractured several ribs and crushed three vertebral bodies. There was no neurological involvement. The following day in the request for operation it was pointed out that a prolonged recovery period could be avoided if an immediate spinal fusion was performed.

7. The treatment of fractures does not consists of producing x-ray films. It is function, not appearance, that we are after. Last week I saw, in consultation, a fractured scapula. I stated frankly "that in 20 years' experience," I had never seen a fracture of this bone requiring open operation. After our conference, the patient turned to the surgeon in charge and said: "Doctor, you make me a good shoulder and I will personally guarantee that your fee will be more than that allowed by 'your union' for an open correction."

The only way to restore muscular power, in my humble opinion, is by exercise. Can you imagine what a blacksmith's biceps would look like if it were baked, massaged and diathermized for a year without permitting the poor man to use his arm?

8. Slipping or bowing of the fragments occasionally occurs in a well fitted plaster cast. Make frequent check-up x-rays. *When should callous be expected?* In a fractured femur, for example, abundant callous can often be felt and seen in x-rays as early as the fourth or fifth week, but in other patients of the same age suffering from the same condition, it may require four to five months. The "union schedule" allows eight weeks in fractures of the femur. Therefore, in a delayed case, of course the surgical fees will be larger.

FINALLY, in fractures (as in infections) *remember the patient as well as his fracture.* Plenty of milk, salads, fresh vegetables are indicated. (I never felt the administration of calcium or the various vitamins were of exceptional value in promoting union). Lots of exercise is essential and most helpful.

CASE REPORT: I recall a boy of 18 years with a fracture of both legs. *He had been kept flat on his back for over one year.* He was pale, thin and flabby. Before treating his fractures, we hooked up a trapeze on a Balkan frame and began back and arm exercises. He was instructed to make leather belts. You would be surprised how rapidly the boy improved both physically and mentally. He was gotten out of bed at the end of a month and his arms were strong enough to use crutches. In all fracture cases, it is most essential that we have the *whole-hearted cooperation* of the patient. This must be gained at the very onset and maintained through the tedious weeks to the very termination of the case.

Time does not permit us to discuss sprains, burns, dislocations, contusions, concussions, etc. All parts of the human body may be affected either directly (or indirectly) by trauma and I do not mean the "trauma of usage."

I did not mention cartilaginous injuries lest I might go hobby-lobbying. *I do wish to speak, however, about lacerations of the tendons and nerves.* In most of the cases which we see these lesions apparently are overlooked. I grant you it seems unlikely that through a puncture wound of one-eighth inch in diameter, one can sever one or two tendons. Yet this frequently occurs. It only requires a minute to determine whether or not the patient can use the part and it only takes another minute (with a bit of cotton) to test out the sensory nerve distribution. I believe lacerated tendons and nerves should be repaired immediately. In tendon work, I am becoming more conservative and believe that they should be im-

mobilized for a period of from 10 days to two weeks.

Surgical shock, of course, should be discussed in connection with the initial treatment of industrial accidents. The head should be lowered, several hot blankets applied, morphine administered and a small warm intra-venous infusion of saline and 5% glucose started as soon as possible. In the Army they give hot cocoa which furnishes both heat and nourishment. I cannot believe that the administration of a variety of stimulating drugs, such as caffeine, strychnine or even adrenalin, will turn the tide one way or the other. The treatment of shock is a medical as well as a surgical problem.

CASE REPORT: Recently, I saw a prominent man suffering from a coronary thrombosis. Several doctors were present. His color was good, pulse fair. Then someone broke an amyl-nitrate pearl and held it under his nose. His blood pressure dropped, he became ashen and soon his pulse was imperceptible.

WHEN IN DOUBT, TELL THE TRUTH! WHEN YOU DO NOT KNOW WHAT TO DO, DO NOTHING!

In closing, there is one point of *tremendous importance.* As industrial surgeons we will surpass our colleagues who only occasionally see an industrial case, if we take a *most thorough history,* make a *careful* examination, and above all, *keep a proper record.* Our cases should be reported *accurately,* using *pathological* terms and avoiding vague meaningless descriptions. Many cases will be predicated upon the findings and reports of the *first examining physician.* The findings of the operating surgeon are also of the greatest importance. Progress notes, pathological findings and all of the records are often required in order to make a decision concerning causal-relationships. Impartial experts probably take into consideration the findings of the first examining physician and those of the operating surgeons. (We often wonder how these distinguished experts arrive at their decisions.) Certainly, few of us can ever hope to attain this unusual distinction.

I am tempted to tell a story.

CASE REPORT: A powerful Scandinavian, six and a half feet tall, was lifting the jaws of a steam shovel. He sprained his back. We treated him for one year. Strangely enough he could sit down on a chair without any difficulty but when he was placed on an examining table, it was impossible to flex his knees. We sent him to an orthopedic specialist of international fame who found nothing wrong with him physically. Now it appeared that this famous specialist was also on the list of impartial specialists. Nevertheless, he was sent to another specialist whose fame was not so great, but who took the man to the hospital for a period of study. He concluded he needed a fusion of several parts of his spine. Since these two specialists were in disagreement, the referee ruled they should confer and select a third impartial specialist. While all of this was going on, the patient and some other men went into the hold-up business in Brooklyn. Patient was chased in and about many subways in Borough Hall, Brooklyn, like a rabbit running in and out of a series of holes. He got away from two policemen. Finally, he was caught and sent to the penitentiary for one year. The legendary rock pile should strengthen the back of a large number of men. After his release and before his hair had grown in, he appeared at the Labor Department and was awarded a *total disability.* He obtained a lump sum settlement. After this money is used up, I venture to prophesy that his next bloodless stick-up will probably take place at Center and Worth Streets.

IF YOU:

(a) take a careful history,

(b) make a thorough examination,

(c) study the x-rays *yourself* (then confer with a roentgenologist),

(d) study both the gross and microscopic pathology *yourself* (then confer with a pathologist);

IF YOU:

(a) Keep *careful* records,

(b) Give *absolutely unbiased testimony;*

IF you do all these things, will

(a) Some secret committee grant you more desirable *code letters?*

Probably not!

(b) Will you become an impartial specialist?

Probably not!

(c) Will you be considered "a company man?"

Probably not!

(d) Will you become a plaintiff's man?

Probably not!

(e) Will you amass a fortune practicing industrial medicine and surgery?

Probably not!

WHAT THEN WILL BE YOUR REWARD?

You will command the respect and admiration of your patients. They will come to love you.

You will at least have the deep inward satisfaction which comes from knowing *that you are "a good doctor."*

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Employee Health

MR. V. P. AHEARN, presiding at the Forum on "Impact of Employee Health on Industrial and Public Relations," made preliminary remarks and introduced the speakers of this forum.

At this Fourth Annual Meeting of the Air Hygiene Foundation, we have had a fine opportunity to survey the whole field of occupational disease and its prevention. We have received the counsel and advice of men with distinguished records in medicine, in engineering, in law, in management, and in labor organization.

It seems to me a great compliment to the Air Hygiene Foundation and to its management that these men have been willing to take the time to come to Pittsburgh and participate in this round-up of our knowledge of occupational diseases and their control.

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* The Third Instalment of our Abstracts of Principal Papers and Discussions of the Fourth Annual Meeting of AIR HYGIENE FOUNDATION, Pittsburgh, Pennsylvania, November 14-15, 1939.

These men share with you and me a belief that the Foundation has performed a vital service to industry and that its future program is one which should command the support of all who realize that health in industry is a job which industry itself must tackle if burdensome regulations and unpleasant laws are to be avoided.

Industry has already made fine progress on this question of occupational disease. We can take a pardonable pride in the accomplishments of the past few years. The modern industrial environment represents a great improvement over conditions which have existed in the past and which in many cases were admittedly prejudicial to the health of the worker. Industry has therefore shown what can be done, and I am confident that under the auspices of the Foundation, the future months will witness continuous progress toward our goal of ridding industry of the preventable sources of occupational disease.

I have been among those who felt that too much attention was given to the purely punitive phases of occupational disease control. It seemed to me that undue emphasis was being placed upon legisation, both by representatives of employers and representatives of employees. Legislation is always the source of hot controversies, and in the struggle for position which marked the efforts of the contending parties, not enough consideration was being given to the fact that no money compensation, however large, can compensate a man for the loss of his health and possibly his life. Our job in this field must be to prevent occupational disease. I hope we will never lose sight of that fact.

We shall be badly advised if we do not recognize that this whole matter of occupational disease is one of tremendous obligation and tremendous responsibility. Its correction needs the intelligent assistance of all. The engineer must guide us along the path of prevention; the doctor must teach us how to cure and he must help the engineer in teaching us how to avoid conditions which cause occupational diseases; wise laws need to be drawn, not only for the assurance which such laws give to employers and employees, but also because they do act as the spur toward correction of conditions which lead to occupational diseases; management must first recognize the obstacle and then do something about it; and the workers must cooperate in the whole program if industry is to do the job of which it is undoubtedly capable.

Industry wrote a fine page in American history when it grappled successfully with the problem of physical safety. Industry can do the same thing with occupational diseases. It would be futile to deny that when workmen's compensation insurance laws were first proposed, almost every branch of American industry registered its vigorous opposition. It was felt that nullification of common law rights accruing to the employer, and the substitution of fixed schedues to be administered by a state commission, would soon impose intolerable costs upon industry. It was even said that workers would become indifferent to their safety and invite accidents because of the certainty of compensation.

We know now that those fears were groundless. We found that the reduction of accidents brought new compensation—in human health and happiness, and in more efficient industrial operations. This is not to say that all compensation insurance laws have been marked by the ultimate in wisdom, but it does insist that industry itself would be highly vocal today if it should be seriously proposed that we return to the common law system of compensation for industrial accidents.

Not until recently did industry make any serious effort to tell the story of its accomplishments. None can fail to look with satisfaction on the record which industry has made in lightening human labor, in adding to our national wealth, in the creation of new industries and in the furnishing of new employment, in raising American standards to new high levels, in lowering the cost of goods and necessities, and in opening up new possibilities for the satisfaction of human wants. Through research and through the application of a high order of intelligence, industry has done these things, and more recently we have come to understand the importance of industrial achievements in respect to emancipation of the United States from dependence upon importation of certain goods which are necessary in our national life.

Industry at last has begun to tell the public what it has done and what it is doing. Business leaders are beginning to resist the temptation to become overnight experts in constitutional law and are devoting their time to talking about the things concerning which they are really equipped to talk from experience and training. Only recently it has done a grand job of convincing the American public that industry wants peace and is opposed to war. Not so long ago, many professional peace advocates were insisting that the exact opposite was the attitude of industry.

We are going to consider in this forum the impact of employee health on industrial and public relations. The discussion will be led by two men who are thoroughly qualified to do so. We shall hear from them as to how industry can best go about the job of building a favorable good will toward itself in carrying out industrial health programs. But they are realists enough to know that public good will toward industry does not depend upon the coining of trick slogans, and they know that industry will enjoy public good will if it does the job which entitles it to claim that good will. One prominent organization of industry took as its slogan "What helps business helps you," but I often wondered why that was not turned around and phrased: "What helps you helps business." I think that the latter can be more easily supported than the former.

This field of public relations is a brand new one. I think that its fundamental justification has too often been ignored. A lot of fellows named Joe have suddenly bloomed into industrial counselors (whatever that means) and they seem to operate under the fixed conviction that public relations is

a job which represents the industrial equivalent of a theatrical press agent. MR. CARR and DR. SAPPINGTON are happy selections for this program because they know from a long personal experience that public relations is something which is of lasting value only when the industrial policy is based upon a sound public policy. We shall hear from them as to how industry can utilize health in industry as a basis for improvement of public relations. No more important question could come before this body, because regardless of the turn of political events in the future, every worker in the United States has become acutely conscious of the great importance to himself and to his family of freedom from occupational disease. I know that industry, always realistic in the long run, will recognize that fact and adapt itself to it.

MR. C. C. CARR stated that it goes without saying that any manufacturer with an ounce of intelligence realizes the dollars and cents value of industrial health and, when shown, is perfectly willing to spend money to make the conditions of his plants conducive to this result. Furthermore, he has humanitarian instincts over and beyond the money angle and is just as anxious as the employee and more anxious than the rank outsider in having the best possible health conditions in his operations.

Unfortunately, industry has too often been placed on the defensive in the eyes of both employees and the public because much attention has been paid to money compensation to workers whose health has already been lost, to state legislation for an occupational disease law in cooperation with the insurance companies, to answering criticisms of industry after it has been attacked in some specific incident. Too little attention has been given to what industry is doing toward eliminating occupational disease. In short, the engineer and the physician who work quietly and effectively on the long range jobs have had too little public notice while the lawyers, the law makers and the insurance companies have had the limelight. The latter group are essential but a constant parade of their activities builds up a resistance toward industry all out of proportion to the true situation.

Much of this is the fault of industry, itself. When a new safety device is installed, an improvement on an old one, or a new method adopted to improve air or light conditions in a plant, too often the operating department says: "Why publicize it and thereby call attention to conditions that existed before?" I feel certain that there are some members of the Air Hygiene Foundation whose operating people think it might be just as well if nothing were said about their support of the fund. Public relations men have just the opposite viewpoint. They think all these things should be talked about publicly.

Admitting that the operating man who wants to "soft-pedal" these activities, may have an occasional point especially when there is danger of a racketeering lawyer sensing a damage suit for possible "sufferers" before the improvement was made, I cannot see that the attitude of silence is good in the long run. Everyone, whether an industrial worker or not, knows that plant conditions are constantly improving. Perhaps he knows this best if he is an industrial employee. The person who knows least about it is one who belongs to that vast army known as the general public. Announcements of plant improvements or innovations which improve the health and the working conditions of employees should be constantly passed on to the public which is the final referee in any broad discussion leading to legislation.

Furthermore, industry can build for itself a still broader acceptance in the public relations task it has to accomplish, if it gets the public to understand that it is, after all, human. In industry's story of itself to the public it has stressed achievement but has done little on the humanitarian side. Research and development, improved products, lower manufacturing costs, the benefits of integration, creation of jobs and kindred stories are being constantly told in institutional massages while the things industry is doing to improve the health and safety of its employees are infrequently mentioned.

DR. C. O. SAPPINGTON, the second speaker in the Forum on "Impact of Employee Health on Industrial and Public Relations," summarized his remarks as follows:

1. The cost of illness among industrial employees is the greatest drain upon industry. Industrial health work can be the most significant factor in the control of these losses.

2. The evolution of most industrial health services has been slow but substantial. A start can be made only by knowing one's own situation, and obtaining and applying expert knowledge properly. Confidence and quality of service are the fundamentals.

3. The problem of small group services has become a fetish. Definite experiences have shown the possibilities, and tangible results well in proportion to money expended. No small group need be without a valuable form of health service.

4. An ideal service makes possible continuity of employment; increase in quantity, quality and permanence of production through improved health conditions.

5. Personal health means different things to different people; basic factors are heredity and early environment, but simple principles coupled with adequate information and the will to do have accomplished great results. Sound health information, continuously and wisely administered (adult health education) is a prerequisite to successful industrial health work.

6. Industrial medical services need more emphasis on important health procedures, such as pre-employment and periodic examinations, supervision of the correction of physical defects, and first aid to minor illnesses. Beneficient results of such measures are now too obvious to be overloked by any but the pecuniarily stubborn.

7. The objections of most employees to these procedures are not usually founded on facts, but mainly on misinformation, superstition, and most

of all, on the fear of losing a job. The greatest proportional returns can be secured through these measures, but they cannot accomplish this end if arbitrarily used as "clubs."

8. The sources of the most costly kinds of illness among employees are largely non-industrial—but the effects are industrial. Control is possible through the application of industrial resources, however, in cooperation with those of the community and private physicians. It is impossible to separate from industry the good influence of industrial health on the community, including homes and schools.

9. Among the special problems which will receive greater attention in industrial health work in coming years are fatigue, posture, noise, nutrition, mental hygiene, absenteeism, recreation, illumination and ventilation. Much has been done on most of these, but if we could apply present information, the salutary effects would be amazing; although more research may be indicated and although many are enticed by the glamour of research, the vital need is prompt and adequate use of what we know.

10. Industrial physicians (as have most non-industrial physicians) have by and large been repairmen in the past, with some exceptions. There have been great accomplishments in public health but these have never been applied in any large sense to the industrial population. The industrial physician should be a very influential and vital factor in the furthering of this cause.

11. Effective administration of industrial health services depends upon a clear conception of objectives; a balanced humanitarian and financial point of view; the steadfast cooperation of medical, industrial relations personnel, safety staff, and employees—and last but not least, an unwavering and insatiable ambition and drive, unremittingly kept going.

12. Industrial health has and will continue to pay dividends upon whatever basis one may choose to calculate them—but the most important of these are the human dividends.

Labor's Viewpoint

MR. ROBERT J. WATT, International Labor Representative of the American Federation of Labor, presented "Labor's Viewpoint on Occupational Disease Prevention." [The abstracter, in order to preserve the vitality of the essayist's delivery, here drops into the first person.]

As a representative of the American Federation of Labor I am glad to accept the invitation of your organization. In times like these when the slash of savagery and the destruction of human life are prevalent throughout the world, it is a real pleasure to join with an organization dedicated to preserving the lives of our people. I have great respect for an organization which, financed by industry, is conscientiously seeking by unbiased scientific study to find and publish the truth about industrial hygiene.

Labor welcomes such an approach. We have long preached the need for industry to find and solve the hazards to which the workers in industry are exposed. We believe that it is essential for the community as a whole and for the employer in particular that every safeguard be undertaken to reduce occupational accident and illness to a minimum. Organized labor welcomes the encouraging initiative which industry has shown in its support of the Air Hygiene Foundation, and the resolution which was adopted unanimously by the delegates attending the recent convention of the American Federation of Labor will indicate the interest of our members in this problem.

(This resolution (No. 3) pointed to the number of industrial accidents, deaths and economic losses involved, stated that "only about 40% of the workers in the U. S. have the protection intended by workmens compensation laws," and urged organization of union committees to promote safe and healthful working conditions; inclusion of safety and health clauses in union agreements; proper state regulations; extension of workmen's compensation and the reduction of compensation insurance costs.)

In focussing your efforts to eliminate industrial diseases from industry, you have adopted the very realistic but too often ignored truism: 'A man's health is more important than monetary compensation.'

We of the American Federation of Labor who have agitated so vigorously for adequate workmen's compensation coverage for industrial accident and occupational disease do endorse your slogan without reservation. Our efforts to extend and increase insurance coverage do not represent any conflict of thought on this score. We believe that the more expensive accident and illness become to industry, the more intelligent and adequate will be the steps taken by industry to prevent these hazards.

Our firm belief is that prevention work can best be handled by impartial institutions such as the Air Hygiene Foundation, the U. S. Department of Labor and similar groups. We believe of course that some form of public health and disability insurance must supplement the work of prevention and cure but I realize that this meeting is concerned with the one issue of prevention.

Whether we approach the subject of safety and prevention from an economic or from a humane standpoint, we maintain that there is something radically wrong with the mechanics of safety and prevention programs when a State, or even an industry runs a record of fatal injuries that is two or three times greater than the standard accepted as average.

Just a short time ago, my attention was called to an analysis of more than five million compensable cases in seven States, and a comparison with the experience stated in the American Accident Table. It occurred to me that even if the basis for comparing the record of these states with the experience of the American Accident Table might be subject to some adjustment, nevertheless, adequate safety and prevention programs could do much to correct the wide discrepancies among these States—the lowest of which had 923 fatal injuries per 100,000

cases, and the highest of which had 2,406 fatal injuries per 100,000 cases.

We are told by experts that occupational diseases are largely preventable, and with respect to silicosis—which has received so much consideration the last few years that it has overshadowed the larger general problem of occupational disease—medical experts seem to be unanimous in stating that this disease, silicosis, is about 95% preventable. The industrial States that have kept records have clearly established that not more than 2.5% to 4% of all industrial injuries are due to what may be termed occupational diseases, and that approximately one half of these are covered by the term 'accidental injuries.'

It would seem quite reasonable to suggest that there would be very few occupational disease problems if every possible means of prevention were investigated, and known methods put into effect through appropriate legislative standards, such standards to be supported by adequate technical and enforcement staffs and maintained by sufficient appropriations.

There will always be some employers to whom the saving of human life is a sufficient incentive. They do not wait for the enactment of a law or the promulgation of rules. But there are others who take a different view and weigh the dollar and cents gain against dollar and cents loss. Then there are others who do not care and who whine about government interference, but who are willing to sacrifice their workers in the hope of getting the jump on their competitors. So there must be power to enforce and to exercise that power efficiently and reasonably through adequately trained and enforcing staffs.

When we get the laws and the rules, and provide for technical and enforcing staffs, we may not get results because the legislature refuses to appropriate funds enough. Labor departments have never been burdened with excessive appropriations, and I should like to suggest that this is one instance where employer and labor groups could get together in an effort to minimize suffering and preserve human life.

Your slogan, 'A man's health is more important than monetary compensation,' serves as a good introduction to the subject of compensation which labor considers is one of the fundamentals. It cannot be left out of the picture when we consider safety and prevention or the problems of occupational disease.

A scientific approach will recognize this fact, and unbiased findings cannot result until it is recognized. Even if the safety and prevention programs achieved satisfactory results there would still be industrial accidents. Those accidents or injuries will result in disability, and sometimes in death. So while there should be concerted and continuous effort to prevent industrial accidents and diseases there should and must be coupled with every prevention program adequate provision for compensating those who meet with injury and suffer disability or death.

Labor will continue to insist that adequate provision doesn't mean merely passing a 'good law' which protects both the employer and workers. There is only one legitimate ground for a difference of opinion between the employer and the worker, and that occurs when a law is under consideration on the question of what should be the maximum benefits.

But once a law is passed, the interests of the employer and worker should be as *one*. The worker is entitled to all the benefits provided in the law, not only because it is the law but because this employer pays premiums for that very purpose. The employer is entitled to get this protection at a reasonable rate. The State has the power and it should be its duty, to tell the employer that he must guarantee payment through insurance, and the State also has the power and it should be its duty to see that the premium rates are reasonable as well as adequate.

Year after year when workers petition for the adoption of more liberal workmen's compensation laws, employers have been scared by the warning often repeated 'your premium rates will be confiscatory.' This has been particularly true with reference to occupational disease coverage. The employers have been told over and over that general or blanket coverage would bring in mumps and measles This has all been done despite the fact that the record speaks for itself.

Let's take the State of Wisconsin for example. That State has the broadest possible blanket coverage. The law says 'Injury is mental or physical harm to an employee caused by accident or disease.' Yet under that provision, only 2.9% of all the compensated cases in 1938 were occupational disease cases, and they represented about the same percentage of the cost of all cases. Under every one of the 47 State Workmen's Compensation Laws (no law in Mississippi) the injured worker faces different conditions and terms, different methods of handling funds and claims, and differences in the administration of the law, and in many of the States no preventive measures at all.

The American Federation of Labor is opposed to this system. If the conservative estimate as to the number of individuals exposed to harmful quantities of silica dust may be set at 500,000 the problem directly or indirectly affects all of them and their families, or a total of nearly 2,000,000 people in the United States. In our opinion it is sheer folly to continue this crazy system, and ignore the necessity of constructive and long range action with prevention as the first step.

If employer and workers agree that the laws were enacted to meet the cost of industrial injuries fairly, why should compensation for occupational diseases be limited to workers who are incapacitated by certain poisons like lead or silica as it is in many States? Why should workers who suffer from other occupational diseases be compelled to bring suit under the common law of employers' liability? There should be only one fair test and that test should be—did the worker receive the injury during the course of his employment?

June Meetings

AS ANNOUNCED, the American Association of Industrial Physicians and Surgeons will hold its Twenty-Fifth Annual Meeting, in conjunction with the First Annual Meeting of the American Industrial Hygiene Association, at Hotel Pennsylvania, New York City, June 4, 5, 6, and 7, 1940. The Program, prepared by Dr. L. A. Shoudy's committee, is tentatively as follows:

Thursday, June 6

9:00—Business, Committee Reports, etc.
9:30—President's Address—McIver Woody, M.D., President, American Association of Industrial Physicians and Surgeons.
9:50—"Pre-Employment Physical Examination"—Harry A. Nelson, M.D. Discussion, J. J. Wittmer, M.D.
10:30—"Care and Handling of Traumatic Injuries"—John J. Moorhead, M.D. Discussion, H. V. Spaulding, M.D.
11:15—"Back Injuries"—J. Huber Wagner, M.D. Discussion.
12:15—Round Table Luncheons, separately held, on the following subjects:
"New Drug Therapy"—J. M. Carlisle, M.D., Medical Director, Merck & Co.
"Toxicology in Industrial Medicine"—J. H. Foulger, M.D., Director, Haskell Laboratory of Industrial Hygiene.
"Who Can Work: Evaluation of Physical Fitness for the Job"—Michael Lake, M.D., Medical Director, R. H. Macy & Co.
2:00—"Problems in Diagnosis and Management of the Nucleus Pulposis"—Byron Stookey, M.D. Discussion, Jefferson Browder, M.D.
2:40—"Injuries Involving the Elbow Joint"—Philip D. Wilson, M.D. Discussion, Joseph L'Episcopo, M.D.
3:20—(Subject to be announced)—Wm. Darrach, M.D. Discussion, Clay Ray Murray, M.D.
8:00—Twenty-Fifth Annual Dinner.

Friday, June 7

9:30—"Diagnostic Criteria in Lead Poisoning"—Elston L. Belknap, M.D. Discussion, Irving Gray, M.D.
10:15—"Hygiene Aspects of Welding in the U. S. Navy"—Discussion, Emerich von Hoam, M.D., Ohio State University.
10:45—"Occupational Dermatitis"—Marion Sulzberger, M.D. Discussion, H. J. Schwartz, M.D.
11:30—"Silicosis"—L. E. Hamlin, M.D. Discussion, Le-Roy U. Gardner, M.D.
12:15—(Subject to be announced.)
2:00—Call to Order; Reports of Committees, etc.
—"Effort and Trauma in Coronary Occlusion and Insufficiency"—Arthur M. Masters, M.D. Discussion.
2:50—"Trauma and the Peripheral Vascular System"—Irving Wright, M.D. Discussion, Gilbert Marquardt, M.D., Chief, Vascular Clinic, Northwestern University Medical School.
3:30—"Shock"—John Scudder, M.D. Discussion.
—Summation—Cassius H. Watson, M.D.

THE program of the First Annual Meeting of the American Industrial Hygiene Association is being developed to have a wide appeal to all who are interested in industrial hygiene and will in addition include technical material for those who are confronted with specific occupational disease problems.

The more general phases of the subject, including such environmental conditions as pressure abnormalities, noise and fatigue, are to be presented on the first day of the meeting.

The results of a group of general industrial hygiene surveys recently conducted are to be discussed by those actively connected with this work. Of much interest will be a report on the results of animal experimentations conducted over the past two and a half years to obtain specific information on the effects of exposure to fumes and gases resulting from arc welding operations. Much new work has been in progress in connection with lead exposures, and it is believed that the findings will be of value not only to those connected with the industries where the studies were made but also in other types of operations presenting lead exposures.

Since a considerable group of men who are at work on technical phases of occupational disease control will be present, a session is to be devoted to methods. This will include technical details of methods for sampling industrial atmospheres for hazardous materials, methods of analyzing these samples, and the application of the results in the control of the exposures. The tendency has been to develop methods of determining the degree of exposure by equipment which can be operated without special training and which will give the desired results without resorting to laborious laboratory procedures. A number of such easily operated instruments are to be discussed.

As the control of the occupational exposure is probably the most important phase of industrial hygiene, the program is to include papers both on general application of control measures and also measures which can be applied to specific problems in so far as these may be encountered in a considerable group of industrial plants.

New data which have been uncovered by toxicological research over the past year will be reported upon. Since recent publications have tended to alter somewhat our former concepts of benzol poisoning, much importance is to be given to unpublished findings of the United States Bureau of Mines on a number of phases of research which has been in progress at the Pittsburgh Experiment Station on this solvent.

The sessions are to be terminated by a business meeting of the American Industrial Hygiene Association. This is the first such meeting after organization of the Association and all members are urged to be present.

Thus the program of this First Annual Meeting of the American Industrial Hygiene Association is to include the outstanding advances in the industrial hygiene field during the past year, will present a broad interest to all concerned with industrial hygiene either directly or through allied activities, and will include specific material which can be applied to individual problems. It is believed that this meeting will serve to stimulate further activity in recognition and control of potential hazards to the end that industries may carry on their operations, even where materials and processes may include an intrinsic hazard, without production of deleterious effects on health.

Industrial Medicine
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Anniversary

THE next meeting of the members of the American Association of Industrial Physicians and Surgeons, in New York City, June 4, 5, 6, and 7, 1940 (see page 169), will be the *Twenty-Fifth* Annual Meeting of that organization. The *First* was held in Detroit in 1916.

The anniversary of the completion by industrial medicine of its initial quarter-century of organization has some tremendous significances. First is the fact that for 25 years industrial medicine has been organized medicine. Second, is the basis that when it was organized its organization was effected by a group of more than 100 medical men who, at that time, were full-time medical directors and chief medical officers of industrial concerns. Third, is the background which brought most of those medical men together from identifications with industrial medicine extending back many years, some to the late nineties, and more to the earliest nineteen-hundreds. And fourth, is the expression of the object and purpose of the organization, which persists to this day in the following words:

"The object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for their mutual advancement in the practice of their profession."

Nothing in any subsequent concept of industrial medicine is broader or more clearly defined than that. And little, if anything, added since has been able to do more than repeat and emphasize. The facts remain the facts.

ONE may wonder, then, as to why the flurry, in late years, to discover and recognize. Maybe the careful "diagnostic study," made by Dr. C. O. Sappington, in 1931 (see "From the Archives," page 156) will help to explain what might be called the latency of appreciation outside of the field of industrial medicine itself. However that may be, it is gratifying now that "the head" — pursuing the allegorical reference — is considerably improved. The vision has lengthened, the ears are so vastly better that they are even hearing some alluring nuances, the "right eye" seems to have arrested any progress of its disability, and the mental tests reveal the decreased likelihood of emergence as a pathological case. The "heart," too, is stronger, and more steady; the "lungs" are more clear; the "nervous system" is less nervous; and, while the "muscular and skeletal systems" are still a bit awkward, it must be remembered that they have grown a lot — until now the modifying "industrial" has the comprehensive meaning of "working" when it precedes "health."

But, all the while, there was *life* in the "struggling youth." And steadily it surged and constantly it beat, till now, when the stripling is thought to be needing to be adopted, at least in so far as its putative foster parents are concerned, it is a mature adult, able to stand alone and fight its own battles, and wanting not so much parental solicitude as man-to-man counsel and cooperation. Time was when it badly needed what is now offered. And the need was repeatedly pointed out, *at the time of need*, by Dr. Sappington and others. For example, what recent "diagnosis" of the field of industrial medicine — even the one most naively set forth by the widest-eyed discoverer of what, to him because he just lately saw it for the first time, was a complete new discovery — is clearer, more thorough, or more competent than the one on page 156 herein which was written nearly 10 years ago? The very things that are now so intriguing to the late comers have been the fundamentals of many years to the men who have made industrial medicine what it is.

The field of industrial medicine survived from within itself. And it is the stronger for having done so. It is strong now — *twenty-five years* strong! And it is on the way, and quite far along the way, toward the realization of the opportunity, in Dr. Sappington's words: "for building a character and reputation worthy of the confidence of other medical specialties." Indeed, at its twenty-fifth milestone of conspicuous integrity and achievement in the most difficult of fields and under the most critical of eyes, it needs only recognition to be able to take its place alongside of any specialty. The enthusiasm of its continual discoverers should be viewed, after all, as perhaps a very flattering form of recognition.

INDUSTRIAL HEALTH AND DISEASE

Who's Too Small for a Health Program?

D. M. SHAFER, M.D.,
Committee on Healthful Working Conditions,
National Association of Manufacturers

TWO years ago the National Association of Manufacturers established its Committee on Healthful Working Conditions to promote health in the industries of this country. The Committee—with DR. VICTOR G. HEISER, world renowned medical executive, as Consultant — has studied the value and actual operation of factory health programs throughout industry.

In the ensuing period since the Committee's organization, one question has come up more than any other, particularly from smaller manufacturing concerns—

"Can my plant afford a health program?"

It is this question of expense that often stands in the way of action, for the value of good health for the employees is recognized by all, and naturally the manufacturer wants to do a job in this field if his company can possibly afford it.

The difficulties of reducing the intangibles of a health program to profit and loss figures are obvious. However, a reading of the experiences of other companies and how they can be equalled by any small company will establish the fact that in addition to the increased efficiency, better employment relations, and various other benefits, a health program does definitely pay dividends in dollars and cents.

Many small manufacturers who are asking themselves "Can we afford a health program?" might well rephrase the question to say "Can we afford not to have a health program?"

The health costs in the average company with only the ordinary risks of accidents and disease are worth review:

A 500-man plant has an expectancy each year of 335 days of disability due to industrial diseases and accidents, and 4,500 days due to non-occupational illness and injury. A total of 4,835 man days of disability per year. Translated into money, this represents an average wage loss to the employees of $24,175 a year, based on a $5 daily wage.

Such a loss is inevitably associated with a parallel disruption of production and, in addition, it directly affects the costs of compensation to the company. This amount of loss is in proportion to the number of employees in a smaller plant so that, in a 200-man plant, the wage loss is about $10,000 per year, and in a 100-man plant about $5,000 per year.

That such losses are reducible by a health program was confirmed by company after company surveyed by the Committee. For instance, these are typical comments:

Absenteeism Reduction:

A SMALL processing plant reports: "In consequence (of a health and safety program), compensation cases were cut down from 31 cases per year to 10, and days lost were cut down from 2,430 to 290."

Accident Reduction:

A PACKING plant with about 500 employees states: "We feel that our health and safety program, operating under the guidance of our Medical Department and Safety Committees, has reduced our labor turnover, is appreciated by our employees, and is a paying proposition. During the operation of this program, our frequency and severity rates have dropped 86.78% and 71.22%, respectively."

Labor Turnover:

A 225-MAN foundry states: "As to dollar and cents return, we find that these improved conditions have reduced the labor turnover which is a major expense in a jobbing foundry. Our estimate of training the average molder would be $200 at a minimum, and we can cite definite instances where the employee has left the company only to return a few weeks later due mainly to working conditions."

Compensation Reduction:

A 60-MAN rubber fabricating plant finds: "1938 retroactive compensation credit of 22.6% because of excellent accident and disease experience."

As to the investment necessary to do this, it has been demonstrated by the U. S. Public Health Service that the expenditure by a company of $8 per man per year on a health program should yield a $12, or 150%, return per year to that company.

In evaluating a health program, it is essential to realize that disability, while obviously the cause of compensation payments and practically all absences, is also the basic cause of many accidents, worry to the employee and his family, and frequently—in cases where the disability is not severe enough to make the employee absent himself from work — causes a substantial money loss to the employer by lowering the employee's efficiency and adversely affecting production.

To reduce disability with all its accompanying expense requires the reduction of the *causes* of disability — occupational and non-industrial accidents and disease. This means the operation of *a healthy plant with healthy workmen.* It has been proved that a health program with its doctor and nurse, safety committee and good working conditions can provide this. Although at first glance it might seem that few plants employing 500 men or less could afford the expense of such a program under the usual arrangement, its benefits are available to just such companies at reasonable cost through the established methods outlined in the following:

Here's How It Is Done

THE DOCTOR: The first part of the plan is to secure the services of a part-time physician. He should be able to head up the whole health program, which includes the safety committee of employees who are selected to assist in the work. The doctor should correlate the committee's work and the working conditions activities with the medical program. He should report directly to the man in charge of the plant.

The medical program should provide periodic inspection of the plant in addition to health preservation measures including pre-employment and periodic physical examinations, emergency treatment of employees taken sick on duty, first aid and prevention of infection, diagnosis and follow-up of occupational diseases and injuries, ethical assistance to and cooperation with the private physician, education of employees on health preservation, conference with the management on matters pertaining to industrial health, and accurate medical records.

The best way to obtain the services of a competent industrial physician is to contact an industrial physician's association, your local county medical society, or your compensation insurance carrier. The state medical societies of the following states have committees on industrial health, which will endeavor to put management in touch with suitable men:

Arizona	Illinois
California	Indiana
Colorado	Iowa
Connecticut	Louisiana
District of Columbia	Maryland
Florida	Massachusetts
Georgia	Michigan
	Minnesota

Missouri	South Dakota
Nevada	Tennessee
New Jersey	Texas
New York	Utah
North Carolina	Virginia
Oklahoma	Washington
Oregon	Wyoming
Rhode Island	

A doctor on call is not the answer to your problem. He does not help until the accident or illness with all its attendant costs has occurred. A part-time doctor is preferable, for he can *prevent* damage. He should visit the plant at least once a week. In a number of cases, plants began with a *minimum* of one hour per week for every hundred men. The doctor should know the processes and the substances used in plant production and have complete understanding of the hazards they present. Operations with unusual hazards may require the doctor's attendance for a longer time per week than where such hazards do not exist.

THE NURSE: Experience indicates that a trained registered nurse can be a great asset to the program, not only in the examination of female operatives but, more important, in fostering good employment relations. Such a nurse can be acquired through industrial nursing organizations or the nearest visiting nurse association. She should spend *at least* two hours in the factory per week per 100 workers. Naturally, she will work directly under the doctor's orders. She will proceed, for the most part, on the principle of "standing orders," thus reducing the time required for the doctor's visits in all but emergencies.

In addition to her customary duties, the nurse in some plants acts as the secretary of the safety committee. Other plants have found the woman's viewpoint very effective in maintaining good plant housekeeping. In still others, the nurse works with the personnel department. This plan of utilizing the nurse in other departments and pro-rating her salary among them has made it possible to have the nurse's professional services available in the plant for more hours per week. The nurse and doctor should give first aid training to a group of picked employees so that they can be of immediate help to injured men in case of an emergency.

THE DISPENSARY: The size of the dispensary will naturally depend on the number of employees and the hazards involved. An adequate size for a plant with 200 men or less is 125 square feet; for 200 to 500 men, 300 square feet. The N. A. M. Committee on Healthful Working Conditions will be glad to provide you with an approved list of dispensary equipment. The cost of building these rooms ranges from $300 to $425, inclusive of equipment.[1]

THE SAFETY COMMITTEE: Employees are invariably cooperative in the formation of a safety committee which can be of the greatest service in reporting hazardous conditions or practices and putting remedies into effect.

Great benefits can be realized by the safety committee working closely with the nurse, doctor, and management. The safety committee should make a study of the practices, machinery, and places in your plant which account for accidents. The most advanced safety methods can be learned by participating in the activities of the national and local Safety Councils. *Specific study and information will reduce accidents and the costs of compensation.*

IMPROVED WORKING CONDITIONS: General health features will be handled directly by the doctor in collaboration with the nurse and safety committee. The supervision of heating and housekeeping from the health point of view are usually a part of their duties.

Lighting and ventilation requirements necessitate very specific knowledge. This is particularly true where air contamination and dust, fume, or gas-producing processes are involved. In meeting these problems, much technical advice is available without cost.

For example, most local lighting companies, without charge or obligation, will provide men and equipment to survey plants and make recommendations that will insure the correct amount and type of illumination for all work and processes. In addition, many power companies will provide simple, easily operated instruments to check the maintenance of lighting equipment performance, usually without cost.

The investigation of dust, fume, mist, and gas hazards requires careful engineering study to determine the presence or absence of hazard. Likewise, the methods of control requires expert advice. This knowledge, equipment, and personnel is available from the laboratories of many compensation insurance companies, usually without charge.

If you are not already informed, it may pay you to inquire whether you are in a position to secure the free services of one of the Bureaus of Industrial Hygiene, operated by 29 States and a number of cities. Several universities, insurance companies, and foundations also maintain industrial hygiene departments and will make a complete study of your plant on a cost plus basis.[2]

Many sources of information about occupational diseases exist: insurance companies, safety councils, manufacturers' associations, medical societies, federal and state health and labor agencies, universities and foundations.

CONCLUSION: A health program in a plant with less than 500 men is practical, economically. It can decrease the compensation insurance premiums, the accidents, the number of absences, the labor turnover, and increase the quantity and quality of production. The small plant health program consists of a part-time doctor and nurse in the plant every week on schedule and a safety committee made up of selected employees, assisted by the free or low cost technical medical and engineering services available from many sources. Besides financial savings the program will increase the health of the men, and improve the regard for the company in the minds of the men, their families, and the community.

The Committee on Healthful Working Conditions of the National Association of Manufacturers will be glad to advise on sources of industrial health information which may be of value to you, and to make available the results of its studies on health in industry.

1. In certain localities, a group of plants has built a common dispensary, with a doctor supported mutually. This plan has not been entirely satisfactory in practice unless the doctor actually visits and inspects each of the plants at frequent intervals.

2. Connecticut and several other states give specific guarantees that any information obtained about your plant cannot be used in event of a compensation claim.

Cold Vaccine Study

WE selected 50 employees (25 men and 25 women) who had a record on our files of being subject to mild and severe colds every winter for the last five years.* As a check we took 50 other members of the staff who agreed to take no cold preventive treatment. This latter group were chosen to correspond closely in age, type of work, home conditions, to the 50 who were taking the tablets. Both groups reported once a week to the medical department from October to end of April.'

"Of the 50 who took the treatment, 15, or 30%, had no colds at all, 17, or 34%, had mild colds with no lost time from work; 18, or 36%, had colds with lost time from work. They had about 66 days' lost time or 3½ days per person per cold.

"What about the 50 employees who did not take the cold vaccine or other preventive treatment?

"Of the 50 who took no precautions against colds 10, or 20%, had no colds at all; 24, or 48%, had colds but lost no time from work; 16, or 32%, had colds with loss of time totaling 106 days, or an average of 6¾ days per person per cold.

"The results show that there was an improvement in the health record of those taking tablets. There were no severe reactions to the cold tablets—nausea, vomiting or hives."

* Reported in *Canad. M. A. J.*, by WALTER W. READ, Medical Director, Northern Electric Company, Ltd., Montreal.

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